PAGE'S WEEKLY.—September 1, 1905. Thin Paper Copy for Circulation Abroad.

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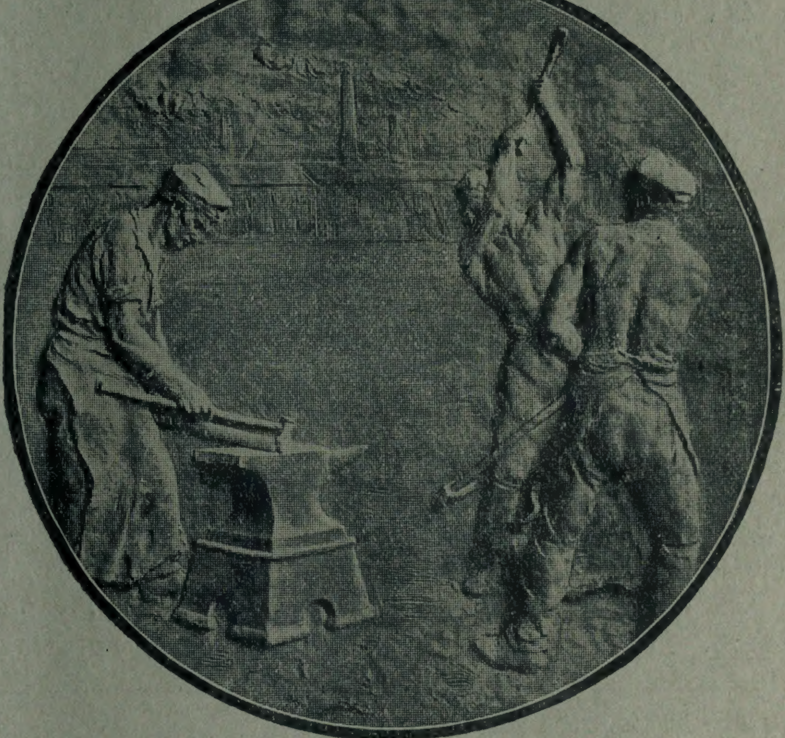
SIXPENCE.
(Registered as a Newspaper.)
FRIDAY,
SEPTEMBER 1, 1905

PAGE'S WEEKLY



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PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
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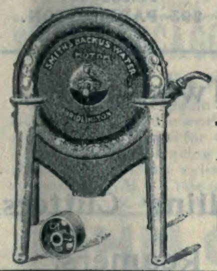

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Will drive any class of Machinery, and work on 15 lb. pressure.
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JOSEPH BOOTH BROS., LTD., See next
RODLEY, LEEDS. week.

LIFTING MACHINERY.

THOS. W. WARD, See Page
ALBION WORKS, 17.
SHEFFIELD.

MACHINE TOOLS.

THE SHANNON, LTD., See Page
Ropemaker St., London, E.C. 68.

OFFICE APPLIANCES.

Have you seen our Advertisement on page ~~69~~ 47 ? A glance at it may save you £500 per annum.—
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Chartered Patent Agents.
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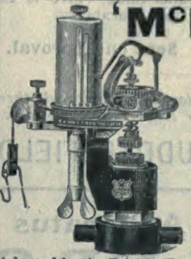

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By EWING MATHESON, M.Inst.C.E.

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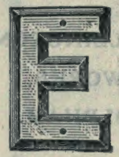

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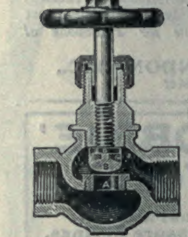
PAGE'S WEEKLY Miscellaneous



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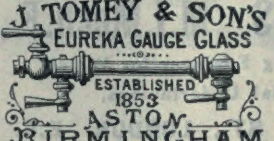

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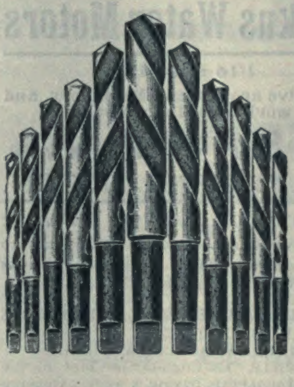

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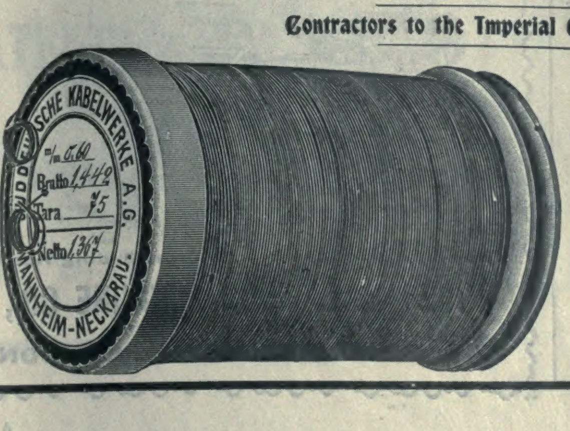

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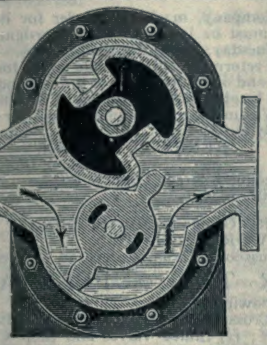

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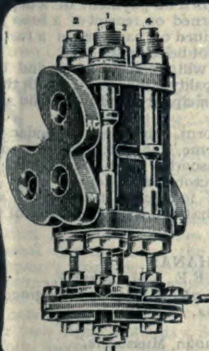

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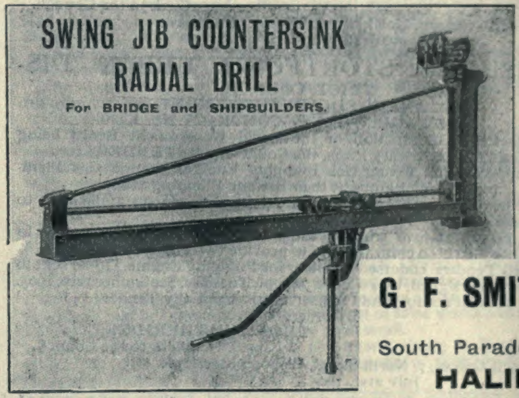

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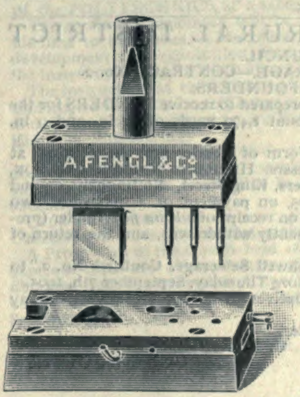

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PAGE'S WEEKLY Contracts

CONTRACTS.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

WATERWORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite **TENDERS** for the **SUPPLY** and **ERECTION** at their Waterworks of a **CORNISH BOILER**, 16 ft. long by 6 ft. diameter, fitted with Meldrum's Patent Furnaces.

Specification and Forms of Tender can be obtained on application to the undersigned on payment of One Guinea, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Waterworks, Cornish Boiler," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, the 19th day of September, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.

Council Offices, 7, North Street, Bishop's Stortford,
August 14th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

AMENDED ADVERTISEMENT.

SEWAGE WORKS.—CONTRACT No. 1.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the Council invite TENDERS for :—

Supplying and Fixing Gas Pumping Engine, Suction Gas Plant and Sewage Pumps at their Sewage Pumping Station.

Specification and Form of Tender can be obtained on application to the undersigned.

The person or firm whose Tender is accepted will be required to enter into a written contract, and to provide two eligible sureties.

Sealed Tenders, endorsed "Tender for Pumping Engine," to be sent to me, the undersigned, by 4 o'clock p.m. on Tuesday, September 12th, 1905.

The Council do not bind themselves to accept any Tender.

By order,
THOS. SWATHERIDGE,
Clerk to the Council.

Council Offices, 7, North Street, Bishop's Stortford,
July 21st, 1905.

URBAN DISTRICT OF PEMBROKE (IRELAND).

ELECTRICITY SUPPLY.

The Council of the Urban District of Pembroke (Ireland) are prepared to receive **TENDERS** for the following :—

Section M.—ELECTRICITY SUPPLY MAINS.
Section N.—ARC LAMPS AND PILLARS.
Section O.—HOUSE METERS.
Section P.—SWITCHBOARD PANELS.

General Conditions, Specification, Drawings, Forms of Tender, and Form of Agreement may be inspected at the offices of the Clerk of the Council, Town Hall, Pembroke, co. Dublin, and at the offices of Messrs. ROBERT HAMMOND AND SON, the Consulting Engineers to the Council, 64, Victoria Street, Westminster, S.W., and may be obtained at the latter on and after Saturday, August 26th, 1905, on making a deposit of £5, which sum will be refunded to *bona fide* Tenderers, after the Tenders have been adjudicated upon. Extra copies of the Specification may be obtained by *bona fide* Tenderers at a charge of five shillings per copy, which sum will not be refunded.

Tenders (sealed and marked "Tender for Electricity Plant") must be addressed to me at the Town Hall, Ball's Bridge, co. Dublin, and be delivered on or before 10.30 a.m. on Friday, September 22nd, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

J. C. MANLY,
Clerk of the Council.

Town Hall, Pembroke,
August 24th, 1905.

SOUTHWELL RURAL DISTRICT COUNCIL.

SOUTHWELL SEWERAGE.—CONTRACT No. 2.
TO PIPEFOUNDERS.

The above-named Council are prepared to receive **TENDERS** for the **SUPPLY** and **DELIVERY** of about 1,470 yards of 12 in. and 9 in. **CAST IRON PIPES.**

Specification, Quantities, and Form of Tender may be obtained at the office of the Engineers, Messrs. HERBERT WALKER AND SON, Assoc.M.Inst.C.E., Albion Chambers, King Street, Nottingham, on and after the 23rd day of August, 1905, on payment of a deposit of Two Guineas, which will be refunded on receipt of a *bona fide* Tender (provided such Tender be not subsequently withdrawn), and the return of all documents to the Engineers.

Sealed Tenders, endorsed "Southwell Sewerage, Contract No. 2," to be delivered at my office on or before Thursday, September 7th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
G. E. KIRKLAND,
Clerk to the Council.

Southwell August 18th, 1905.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED,

is prepared to receive **TENDERS** for the **SUPPLY** of **BRIDGEWORK** and **PERMANENT-WAY MATERIALS** as under :—

1. BRIDGEWORK, 10 ft. to 30 ft. and 70 ft. spans, about 950 tons.
2. RAILS, 41¼ lb., 50 lb., and 56 lb., 1,735 tons ; and Fishplates for the same, 50 tons.
3. CAST-IRON POT SLEEPERS, 1,265 tons.
4. TIE BARS, GIBS, and COTTERS, 82 tons.
5. FISHBOLTS, SPIKES, and BEARING PLATES, 40 tons.
6. SWITCHES and CROSSINGS, about 100 sets.

Specifications and Forms of Tender may be obtained at the Company's Offices.

Tenders, addressed to the Company, marked "Tender for Bridgework," or as the case may be, must be left with the undersigned not later than 12 o'clock noon of Tuesday, the 5th September, 1905.

A charge, which will not be returned, will be made of 20s. for each copy of Specifications 1 and 2, and of 10s. for each of the remainder.

Copies of the drawings may be obtained at the office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices, 55, Gracechurch Street, London, E.C.,
August 25th, 1905.

MUNICIPAL BOARD OF MUSSOORIE, INDIA.
WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY AND DELIVERY

of the following :—

(*a*) Pipes ; (*b*) Tees ; (*c*) Cross Pieces ; (*d*) Reducers ; (*e*) Bends ; (*f*) Bends and Collars ; (*g*) Sluice Valves and Stop Cocks ; (*h*) Ball and Non-return Valves.

Specifications and Form of Tender can be obtained on application to the undersigned, on payment of a deposit of Rs. 45 (£3), which amount will be returned on receipt of a *bonâ fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 3 (4s.) each, which will not be returned.

The firm whose Tender is accepted will be required to deposit the sum of Rs. 1500 (£100) in a bank, and the receipt, endorsed in favour of the Chairman, must be forwarded with the Tender. This amount will be forfeited on the failure of the Tenderer to execute a formal contract bond within two months of the acceptance of his Tender.

Sealed Tenders, on the prescribed form, endorsed "Tender for Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 9th, 1905.

The Municipality does not bind itself to accept the lowest or any Tender.

By order, C. H. SHANAN,
Assoc.M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.

Municipal Office, Mussoorie. U.P., India,
June 14th, 1905.
Telegraphic Address : "Shanan, Mussoorie."

MUNICIPAL BOARD OF MUSSOORIE, INDIA.
ELECTRIC LIGHTING AND WATER WORKS SCHEME.

The Municipal Board of Mussoorie, India, is prepared to receive

TENDERS FOR THE SUPPLY,

DELIVERY, and ERECTION at sites, in complete working order, of the following plant :—

(*a*) Steel Power Pipes ; (*b*) Water Motors ; (*c*) Alternators with Exciters ; (*d*) Switchboards with Instruments and Apparatus ; (*e*) Transformers ; (*f*) Induction Motors ; (*g*) Pumps ; (*h*) Workshop Machines.

Also for the SUPPLY and DELIVERY of the following :—

(*a*) Bare Copper Wire for Overhead Mains ; (*b*) Insulators and Lightning Arresters ; (*c*) Arc and Incandescent Lamps ; (*d*) Telephone Equipment ; (*e*) Workshop Tools ; (*f*) General Stores.

Specifications, Form of Tender, and General Conditions can be obtained on application to the undersigned on payment of a deposit of Rs. 75 (£5), which amount will be returned on receipt of a *bona fide* Tender. Additional copies may be obtained on payment of a further fee of Rs. 5 (6s. 8d.) per set, which will not be returned.

The Firm whose Tender is accepted will be required to find two sureties to the satisfaction of the Municipality, and to enter with them into a contract to be prepared by the Municipality, and to contain such clauses as it may think necessary.

Sealed Tenders, on the prescribed form, endorsed "Tender for Electric Lighting and Water Works Scheme," should be addressed to the Chairman, Municipal Board, Mussoorie, India, and must be delivered to him on or before Monday, October 23rd, 1905.

The Municipality does not bind itself to accept the lowest or any Tender, nor will it consider any Tender that is not for the whole of the Plant and Material.

By order,
C. H. SHANAN,
Assoc. M.Inst.C.E., A.M.I.E.E., A.M.I.Mech.E.,
Municipal Electrical Engineer.

Municipal Office, Mussoorie, U.P., India,
June 14th, 1905.
Telegraphic Address : "Shanan, Mussoorie."

PAGE'S WEEKLY Contracts and Appointments Open

THE SECRETARY OF STATE FOR

India in Council is prepared to receive TENDERS from such persons as may be willing to supply :—

1. DOG SPIKES for RAILS.
2. WHEELS AND AXLES for CARRIAGES and WAGONS.
3. CARRIAGE IRONWORK AND FITTINGS.

The conditions of contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, the 5th September, 1905, for Nos. 1 and 2; and on Tuesday, the 12th September, 1905, for No. 3, after which times respectively no Tender will be received.

E. GRANT BURLS,
Director-General of Stores.
India Office, Whitehall, August 24th, 1905.

TO SHIPBUILDERS.

THE DIRECTORS OF THE GREAT

Central Railway Company are prepared to receive TENDERS from Shipbuilders for the CONSTRUCTION of TWO NEW TURBINE STEAMERS.

Contract Drawings and Specification may be seen at the office of Mr. F. J. TREWENT, 43 and 44, Billiter Buildings, Billiter Street, London, E.C., on and after Monday, August 28th, between the hours of 11 a.m. and 4 p.m. (except on Saturdays), when copies of the Contract Drawings and Specification and Form of Tender may be obtained on the deposit of a cheque for £5 5s., payable to the order of the Great Central Railway Company, which will be returned on the receipt of a *bona fide* Tender, accompanied by the above-mentioned documents.

Tenders, in envelopes endorsed "Tender for New Steamers," must be delivered, accompanied by the above-mentioned Contract Drawings and Specification, at the office of the Secretary of the Great Central Railway Company, Marylebone Station, London, N.W., at or before noon of Thursday, September 14th, 1905.

The Directors of the Great Central Railway Company do not bind themselves to accept the lowest or any Tender.

(Signed) O. S. HOLT, Secretary.
Marylebone Station, N.W.,
August 23rd, 1905.

GREAT WESTERN RAILWAY.

The Directors of this Company are prepared to receive TENDERS for the SUPPLY of about 230 tons of STEEL BRIDGE GIRDERS and other STEEL and IRON WORK of British Manufacture.

Plans and Specification may be seen, and Forms of Tender and Bills of Quantities may be obtained at the office of the Engineer at this Station, between the hours of 10 a.m. and 4 p.m.

Tenders, addressed to the undersigned, and marked outside "Tender for Girder Work," will be received on or before Tuesday, the 5th September.

The Directors do not bind themselves to accept the lowest or any Tender.

G. K. MILLS, Secretary.
Paddington Station, London,
August 14th, 1905.

COUNTY BOROUGH OF SOUTHAMPTON.

TO ENGINEERS AND OTHERS.

The CORPORATION invite TENDERS for SUPPLYING and FIXING at the Corporation Wharf, Chapel, three 18-in. HIGH-PRESSURE DIRECT-ACTING CENTRIFUGAL PUMPING ENGINES, including all Suction and Delivery Pipes, Steam and other connections.

Particulars may be obtained upon application to Mr. J. A. CROWTHER, A.M.Inst.C.E., Borough Engineer, Market Chambers 123, High Street, Southampton.

Sealed Tenders, endorsed "Tender for Pumping Engines," must be delivered at my office before 2 p.m. on Monday, the 4th September next.

No pledge is given to accept the lowest or any Tender.

By order,
R. R. LINTHORNE,
Town Clerk.
Town Clerk's Office, Municipal Offices, Southampton,
July 21st, 1905.

NORTH-EASTERN RAILWAY. — TO

CONTRACTORS.—The DIRECTORS are prepared to receive TENDERS for the CONSTRUCTION and ERECTION of the NEW STEEL SWINGBRIDGE over the River Hull at Sculcoates, on their Victoria Dock Branch, and weighing about 460 tons. The Contract will include the Removal of the existing Swingbridge, the Raising of the Public Road, and the Building of River Walls, Timber Jetty, &c. Plans may be seen, and Specification, detailed Lists of Quantities, and Forms of Tender obtained, on personal application at the office of Mr. W. J. CUDWORTH, the Company's Engineer, at York, on and after August 14th, 1905. The Directors do not bind themselves to accept the lowest or any Tender. Sealed Tenders, marked "Tenders for the Reconstruction of the Swingbridge at Sculcoates," to be sent to the Secretary at York not later than noon on Monday, September 11th, 1905.

York, August 3rd, 1905. R. L. WEDGWOOD, Secretary.

APPOINTMENTS OPEN.

APPOINTMENT OF COUNTY SURVEYOR.

DERBYSHIRE COUNTY COUNCIL.

The Council invites APPLICATION for the POST of COUNTY SURVEYOR at a salary of £500 per annum, rising by annual increments of £25 to £600. No pension.

The Surveyor shall devote the whole of his time to the duties of the office, and shall have the entire charge of all roads and bridges under the care and control of the County Council. He shall supervise and report on the work of the district surveyors and of the Local Authorities who have claimed to repair their main roads whether under contract or not. He shall attend all necessary meetings, and shall prepare such plans, estimates, and reports as may be required.

The Surveyor must have a thorough practical knowledge of the making and maintaining of roads, of the different materials employed, of the best methods of using steam rollers, and of the management of roadmen, and no testimonials will be considered unless the applicant can show he possesses these qualifications.

The Council will provide offices, clerical assistance, and stationery, and an ample allowance for travelling will be made, but this will be arranged with the Surveyor after his appointment.

The Surveyor must also carry out any further duties that the Council may require from time to time.

The appointment will be made subject to determination on three months' notice by either side.

Canvassing directly or indirectly will disqualify.

Particulars of duties, &c., can be obtained from, and all applications, accompanied by copies of three recent testimonials (originals will not be returned), must be sent on or before the 6th day of September, 1905, to the undersigned. N. J. HUGHES-HALLETT,
County Offices, Derby. Clerk of the County Council.

THE MADRAS RAILWAY COMPANY

REQUIRE the services of a BRIDGE INSPECTOR in India. Candidates, preferably unmarried, must have been trained as platers, riveters, and girder erectors in one of the leading shops in the United Kingdom, and be experienced in the erection of false works and girders and be capable of taking sole charge of such work.

Commencing salary Rupees 250 per month, rising to Rupees 300; after two years of approved service, covenant for four years. Free passage to Madras.

Application, stating age, experience, &c., to be addressed not later than September 18th to W. H. COLE, Secretary.
1, Broad Street Place, Finsbury Circus,
London, August 16th, 1905.

BOROUGH OF KING'S LYNN.

APPOINTMENT OF BOROUGH SURVEYOR AND WATERWORKS ENGINEER.

The Corporation invite applications for the appointment of Borough Surveyor and Waterworks Engineer, at a salary of £250 per annum.

The gentleman appointed must devote the whole of his time to the duties of the office, and must not engage in private practice.

The conditions on which the appointment will be made can be obtained from the undersigned, to whom all applications, endorsed "Borough Surveyorship," and accompanied by copies of not more than three recent testimonials, must be delivered not later than the 18th of September next.

J. W. WOOLSTENCROFT,
Town Clerk.
Town Hall, King's Lynn,
August 22nd, 1905.

COUNTY BOROUGH OF CROYDON.

EDUCATION COMMITTEE.

The Committee invite APPLICATIONS for the Post of PRINCIPAL of the POLYTECHNICS, at a salary of £350 per annum.

The gentleman appointed will be required to devote the whole of his time to the duties of his office, and will be responsible for the development and organisation, discipline, and educational efficiency of the instruction given in the Polytechnics.

The instruction at these centres is, for the most part, given in the evening, and in addition to Classes in Science, Art, Trade, Commercial and Domestic Subjects, there are Evening Courses in Mechanical and Electrical Engineering.

The Principal will also be required to superintend any other evening classes established, or to be established by the Committee, and to advise and assist the Committee in the co-ordination of all classes of education.

Candidates must not be over 45 years of age, and must hold University or other professional qualification.

A Prospectus of the classes held in the Polytechnics, together with copies of the Form of Application and Statement of Duties, may be obtained from the undersigned, to whom applications, accompanied by copies of testimonials of recent date, must be sent not later than September 11th, 1905.

JAMES SMYTH, Clerk.
Education Office, Katharine Street, Croydon,
July 20th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 35, 37, 38, *and* 40.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. *for each additional section.*

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

BY ROYAL WARRANT TO H.M. THE KING

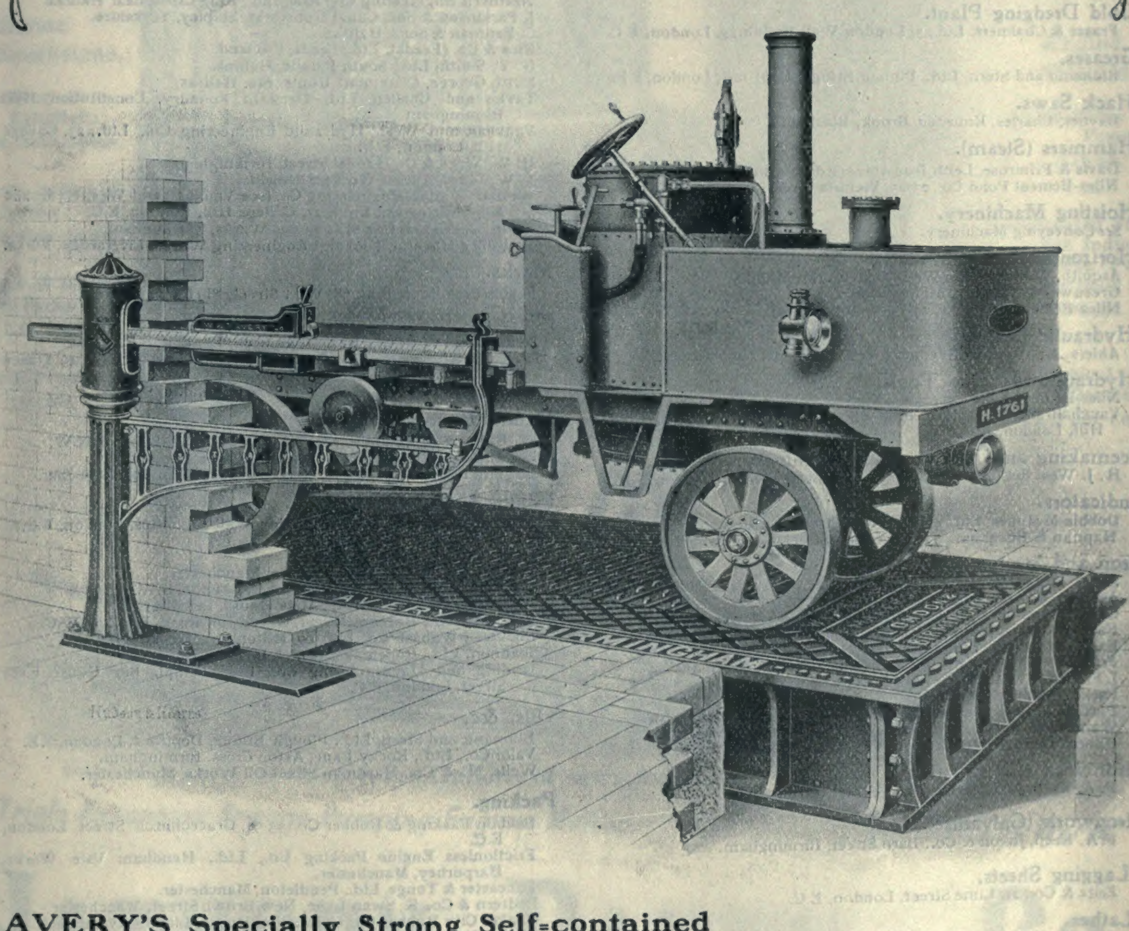
W. & T. AVERY LTD

ESTD 1730

SOHO FOUNDRY

BIRMINGHAM

THE LARGEST MAKERS OF WEIGHBRIDGES IN THE WORLD


H. 1761
W & T AVERY LTD BIRMINGHAM

AVERY'S Specially Strong Self-contained

WEIGHBRIDGES

For Road or Railway Traffic.

Contractors for the Repair and Maintenance of Weighbridges and Weighing Machinery.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London. S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, E.C.
Méguin. Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co., Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Pumping Machinery

Pumping Machinery

FOR WATERWORKS AND MINES.

Official

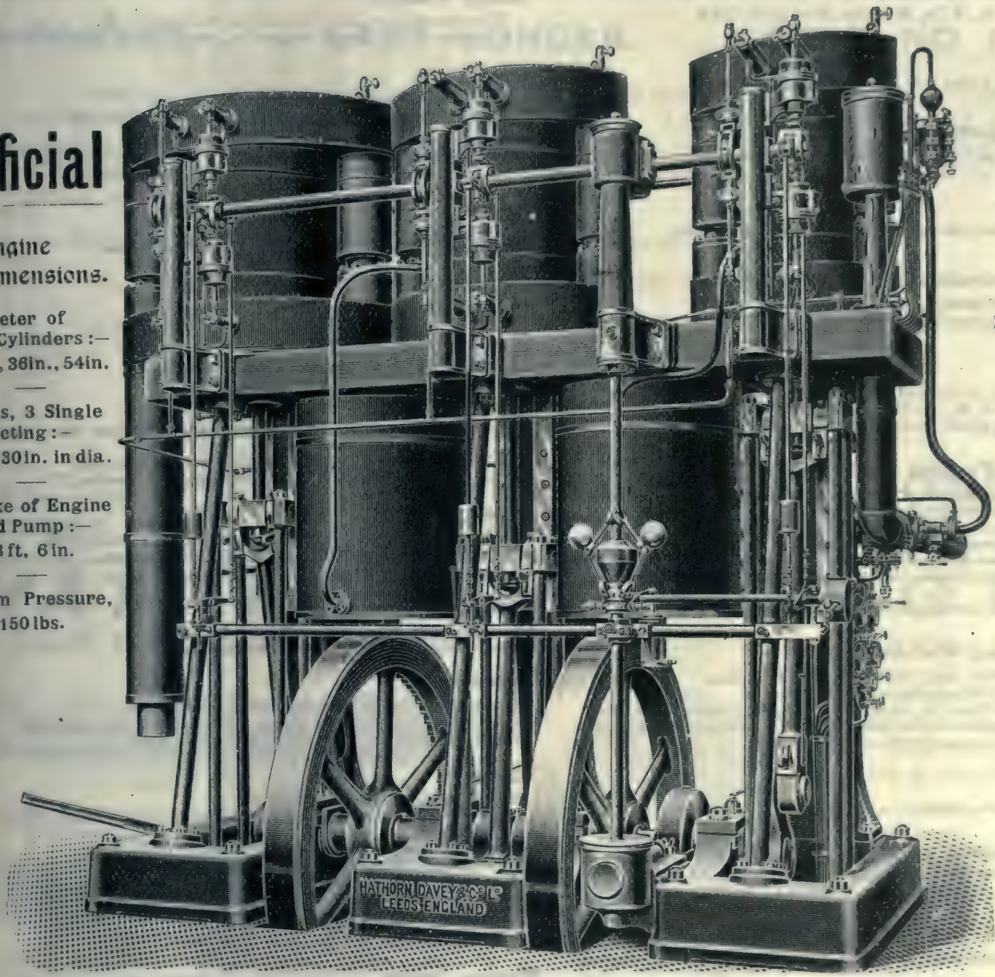
Engine Dimensions.

Diameter of Cylinders :—
20in., 36in., 54in.

Rams, 3 Single Acting :—
Each 30in. in dia.

Stroke of Engine and Pump :—
3ft. 6in.

Steam Pressure,
150lbs.



Trial.

Engine Results.

Pump Horse Power :—
274·55.

Saturated Steam per Indicated Horse Power per hour :—
12·4 lbs.

Mechanical Efficiency :—
92·8 per cent.

Contract Duty to raise 6,240 Gallons of sewage per minute 125 feet high.

Triple Expansion Sewage Pumping Engine, Melbourne and Metropolitan Board of Works.

HATHORN, DAVEY & Co.,

LIMITED,

LEEDS, England.

Codes Used :
A.B.C. 4th Edition.
Universal Mining Code.

Telegrams :
"HATHORN, LEEDS"

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2 Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C
Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 75, Cannon Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

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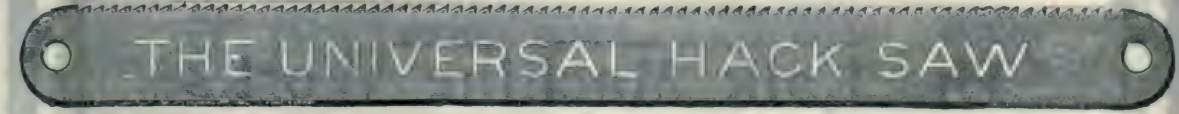

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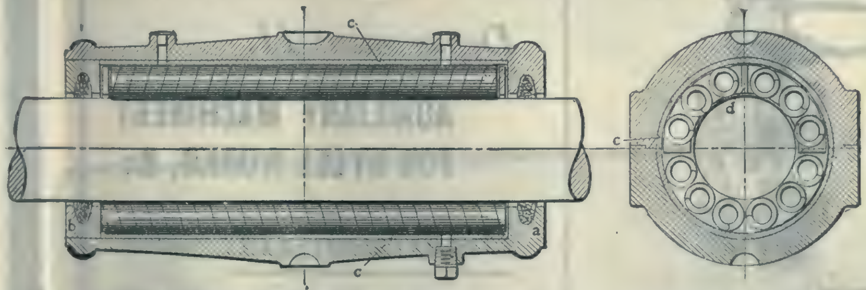

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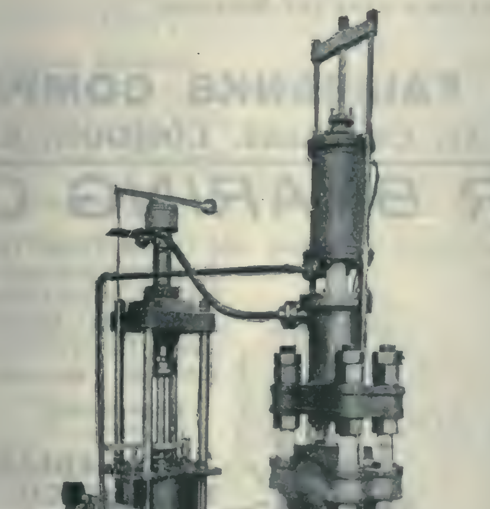

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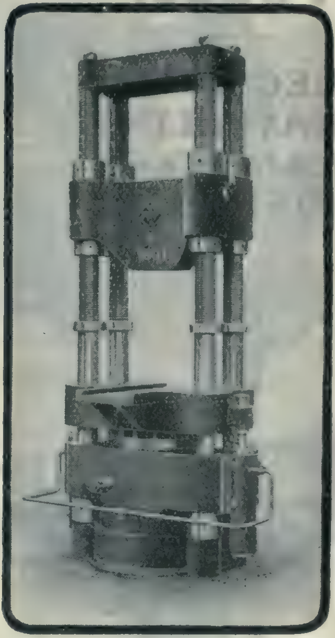
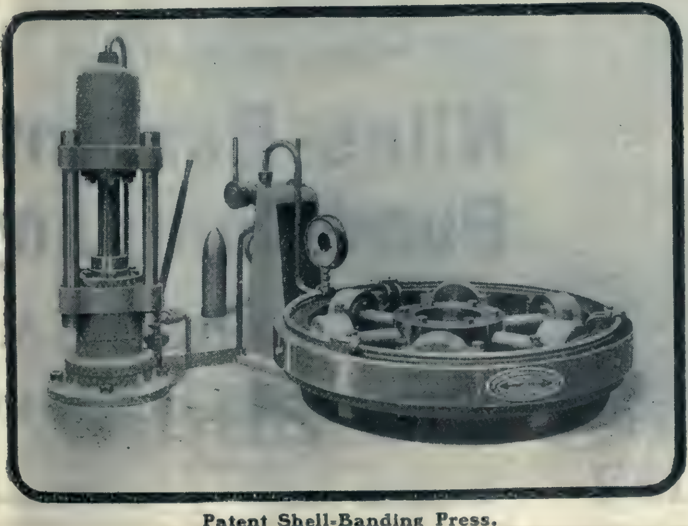


Shell Press.



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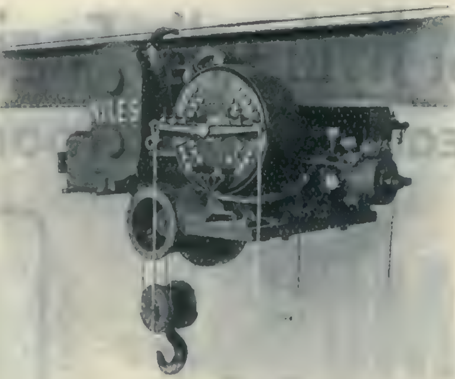

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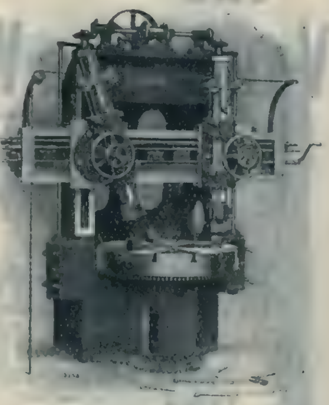

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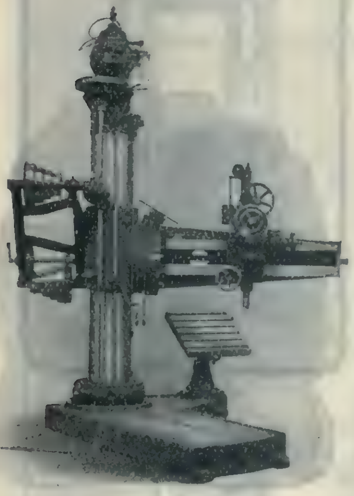

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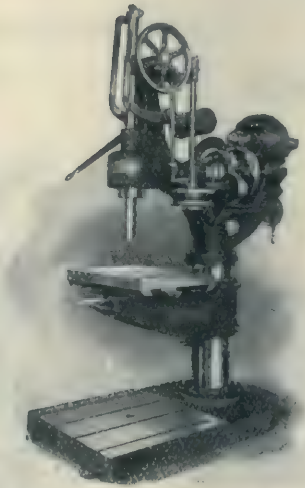

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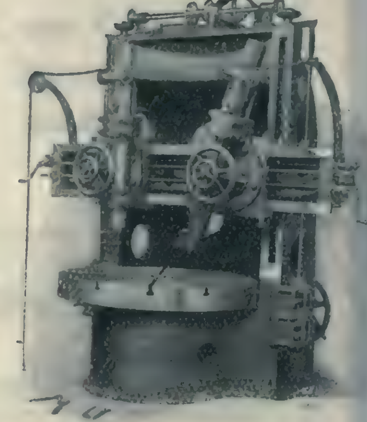

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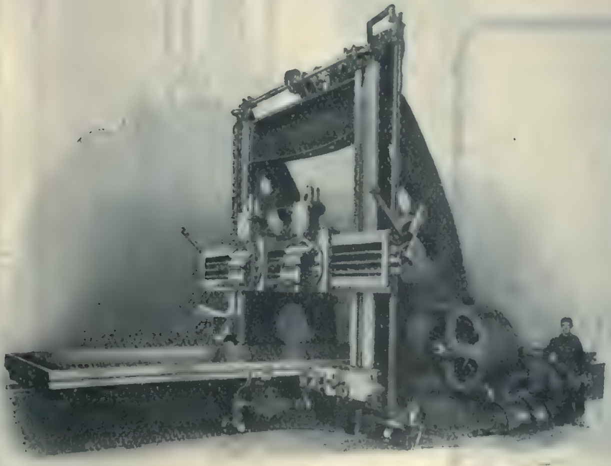

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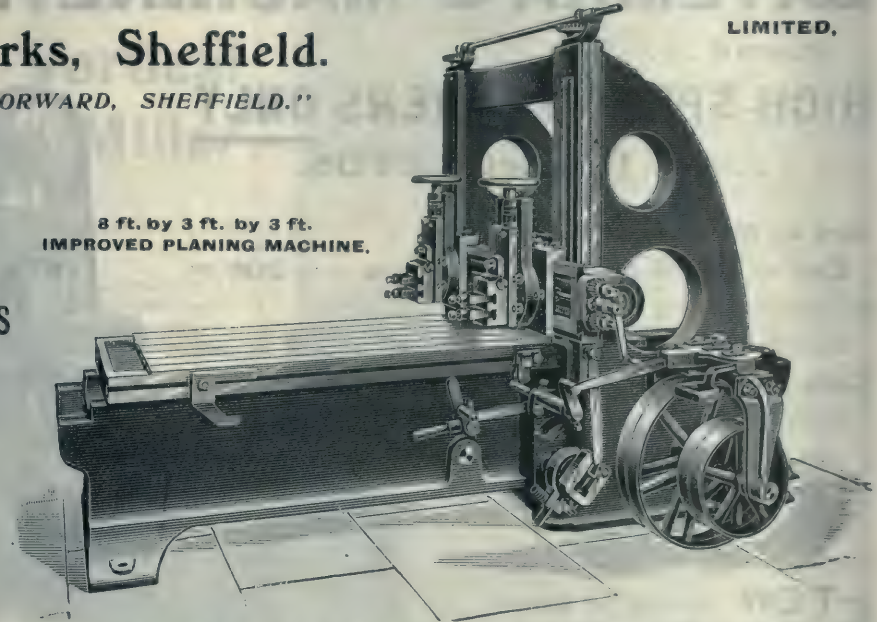
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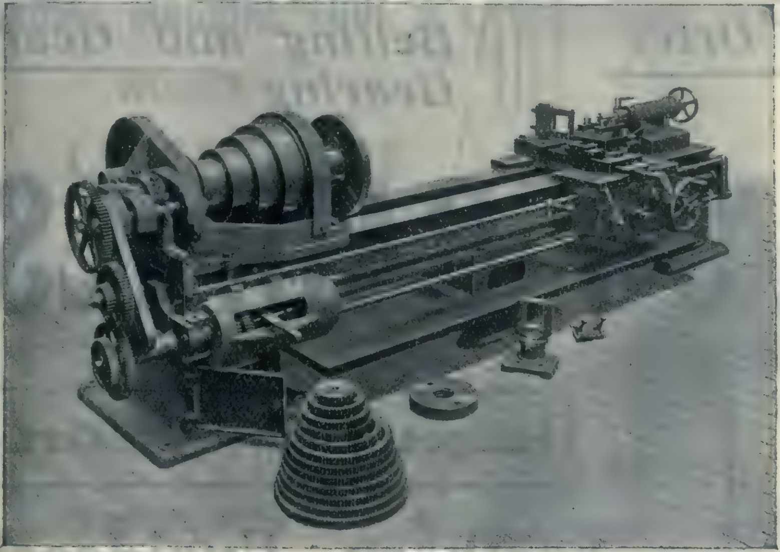

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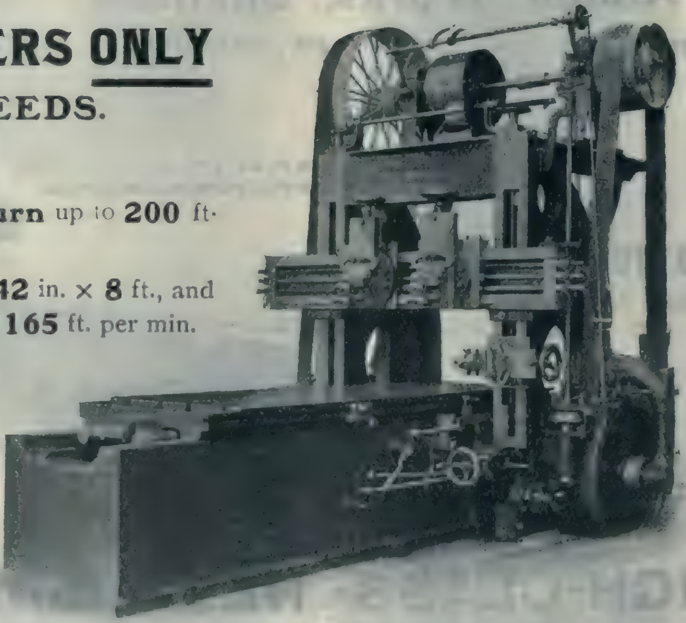

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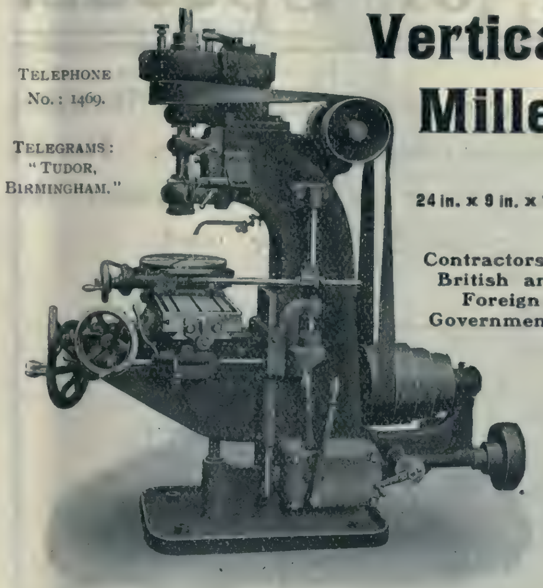

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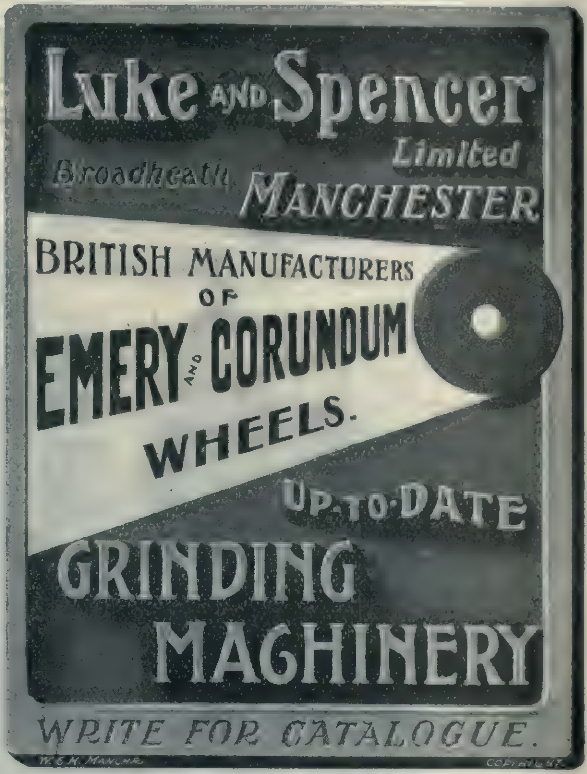

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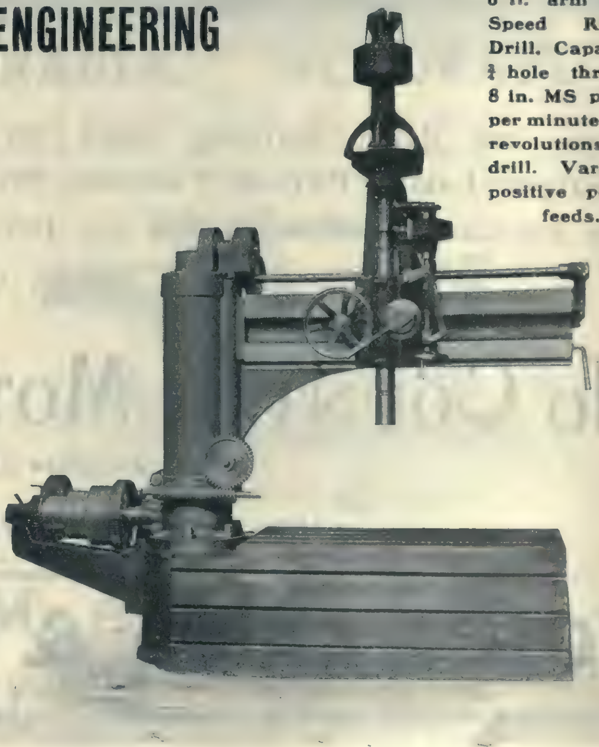

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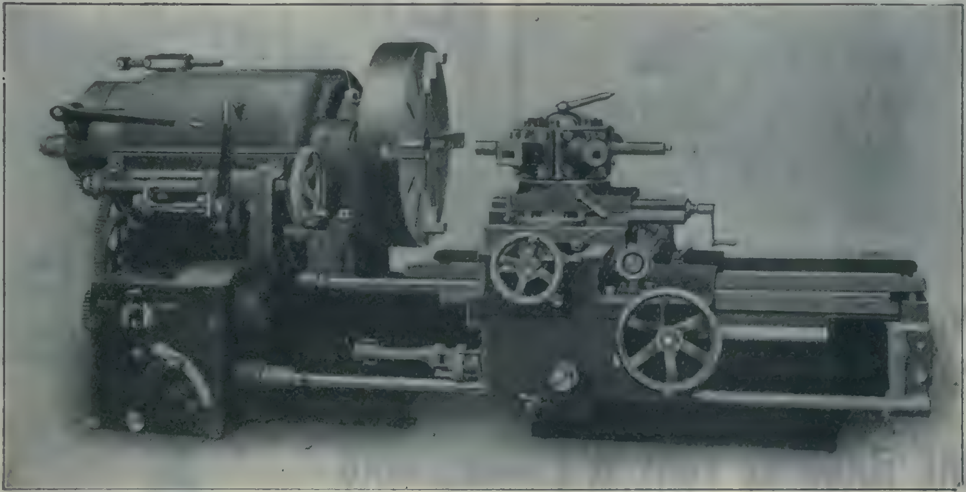

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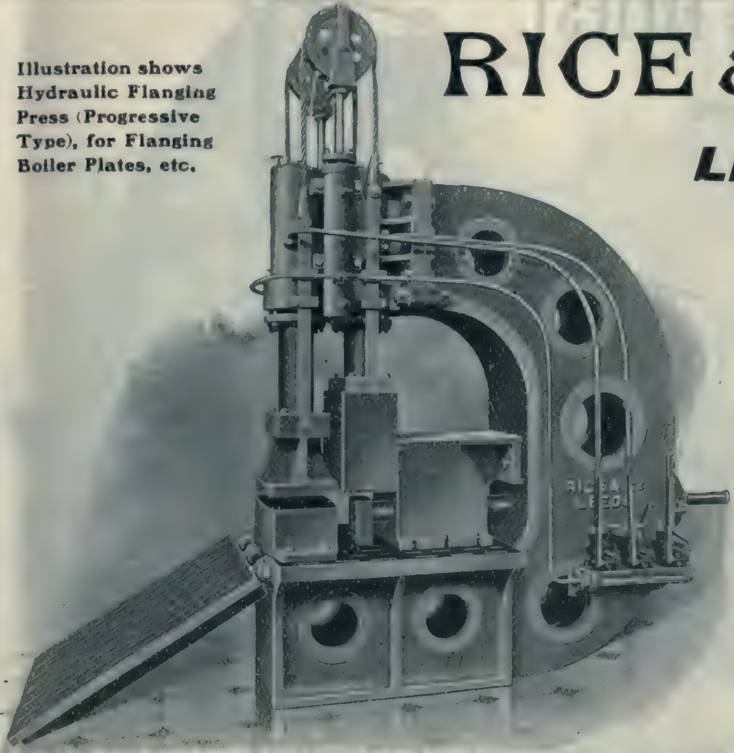

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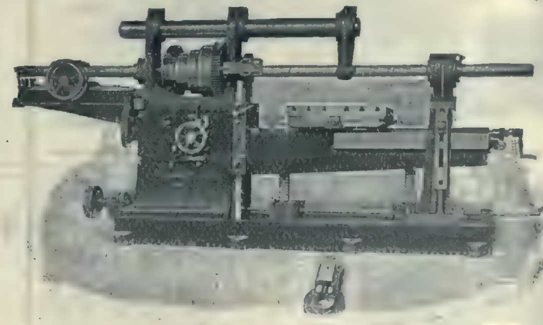

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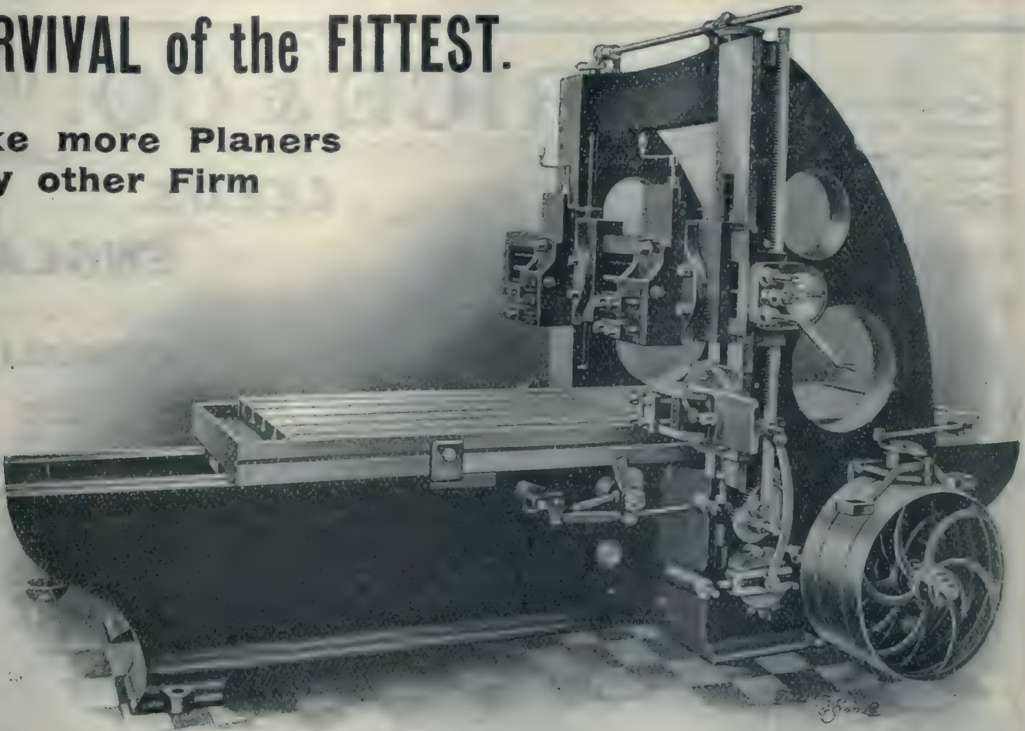

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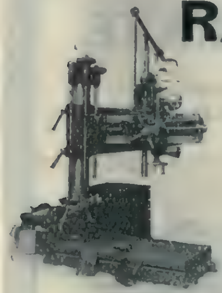

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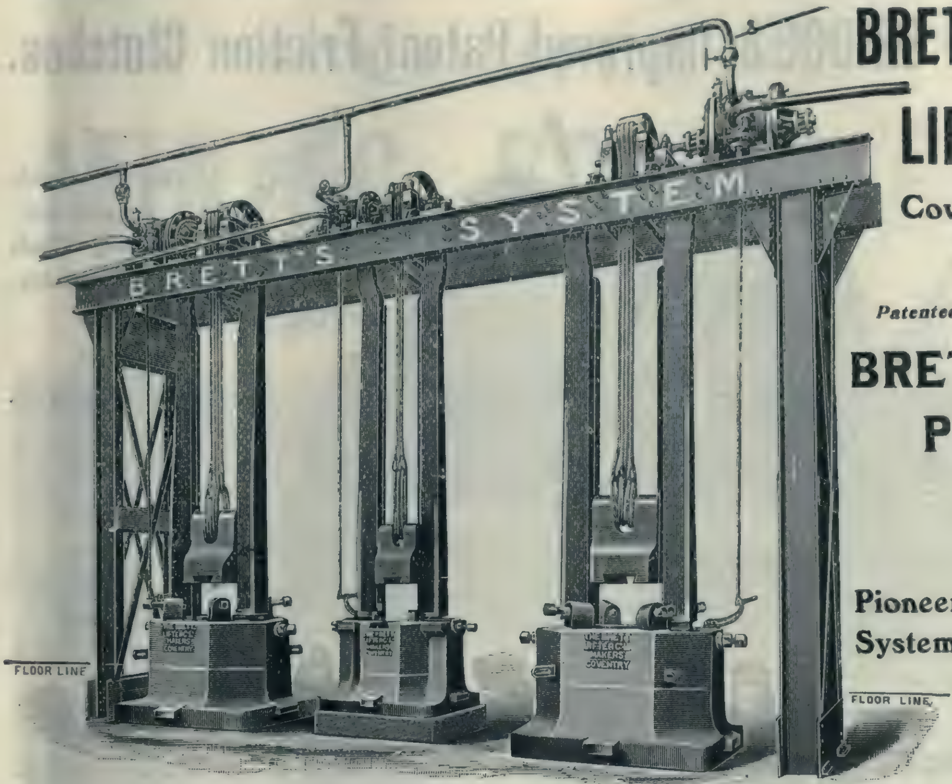

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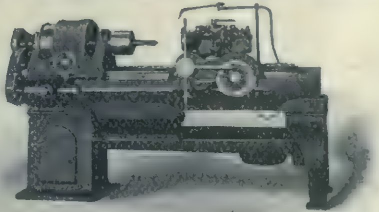

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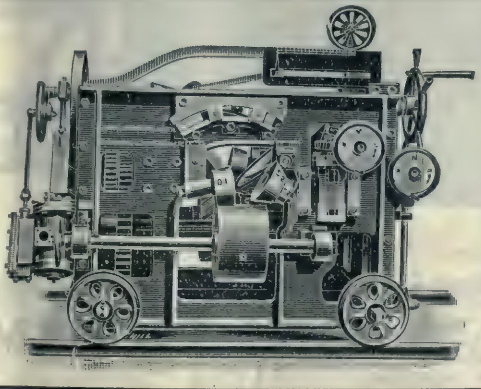

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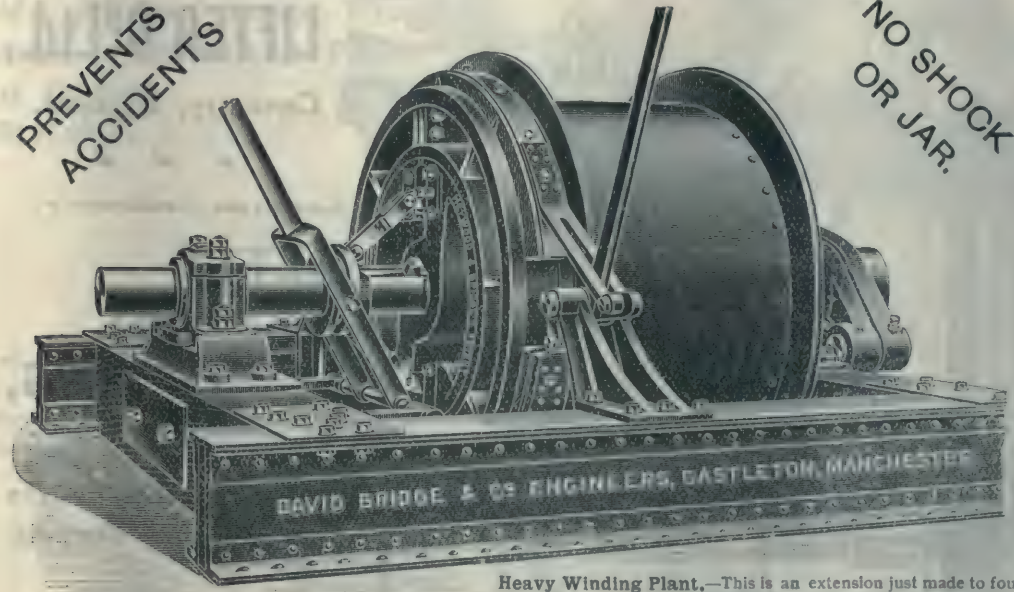
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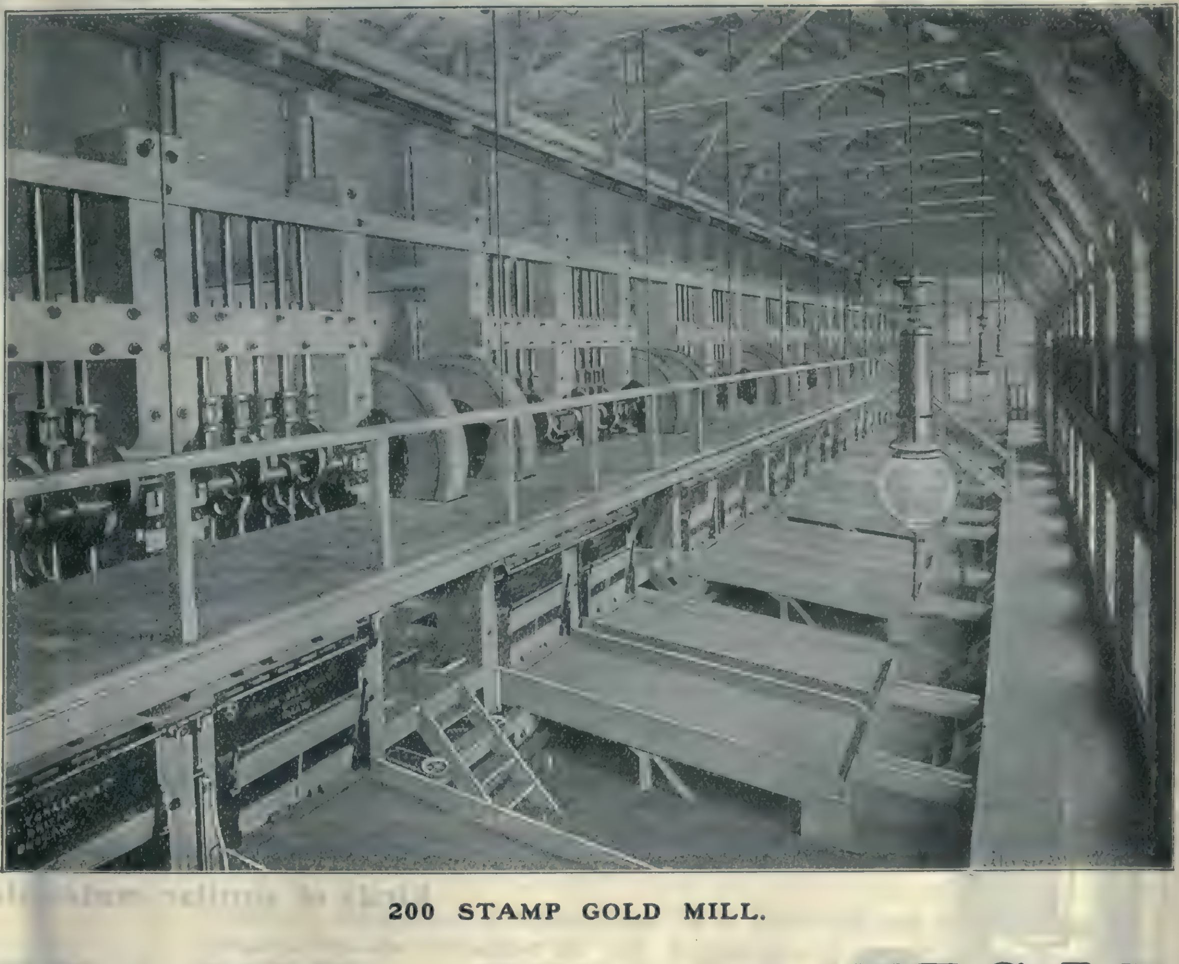

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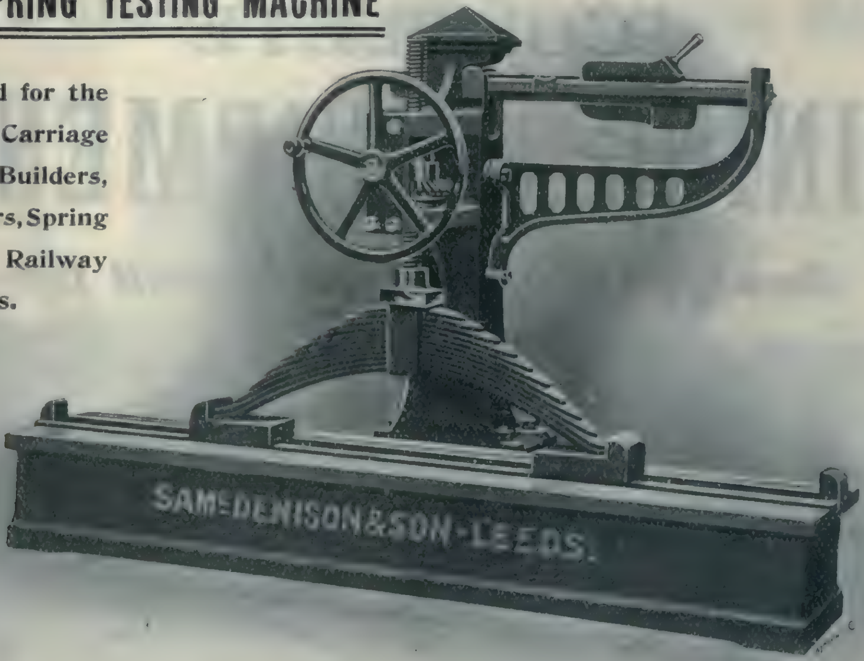

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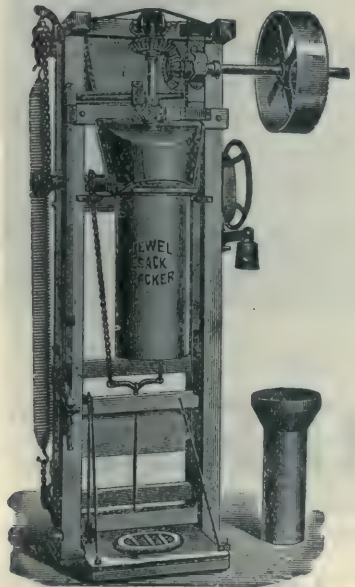

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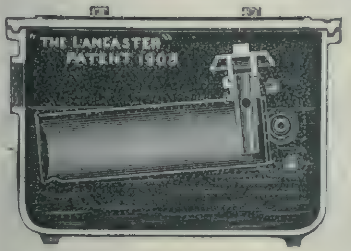

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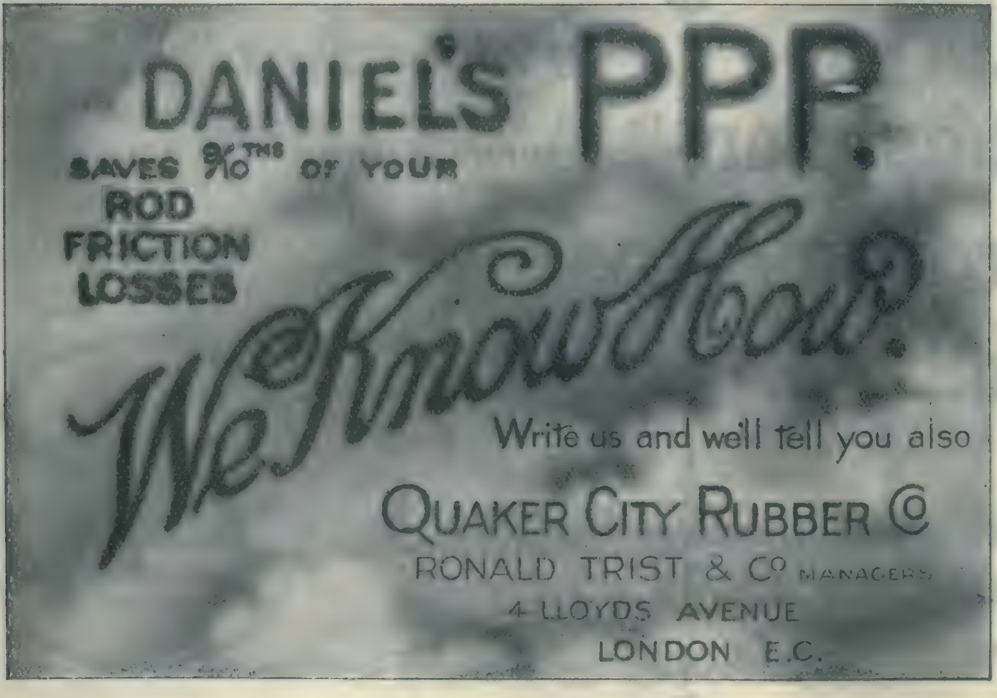

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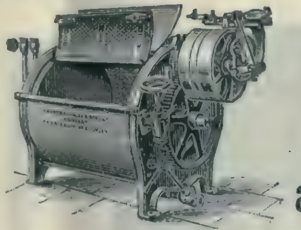

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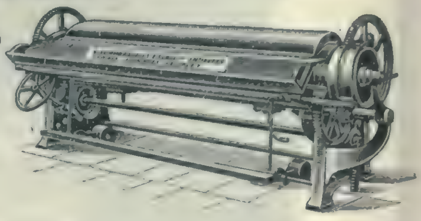

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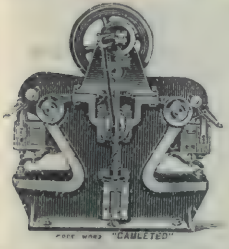
FOR

Engineers,
Shipbuilders,
Boiler Makers,
Etc., etc.



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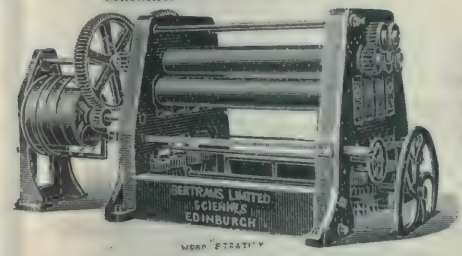

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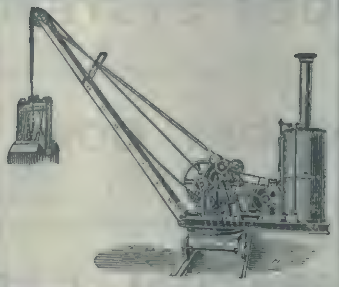

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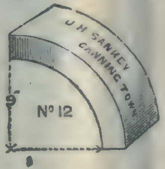

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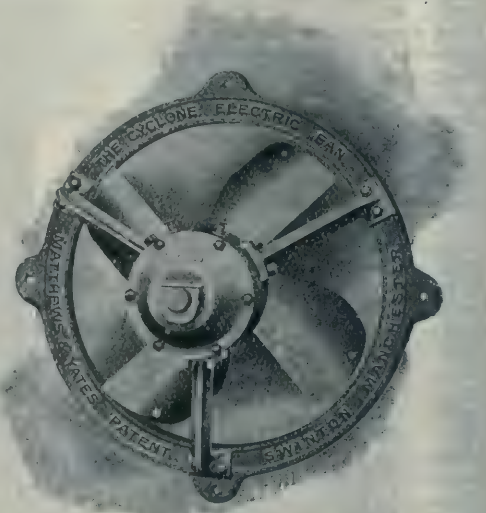

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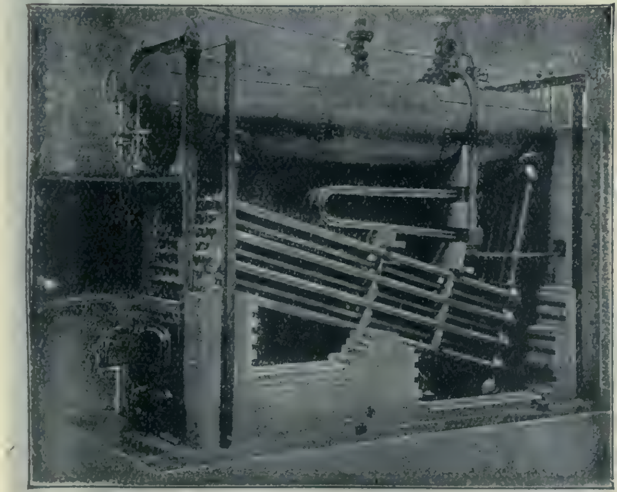

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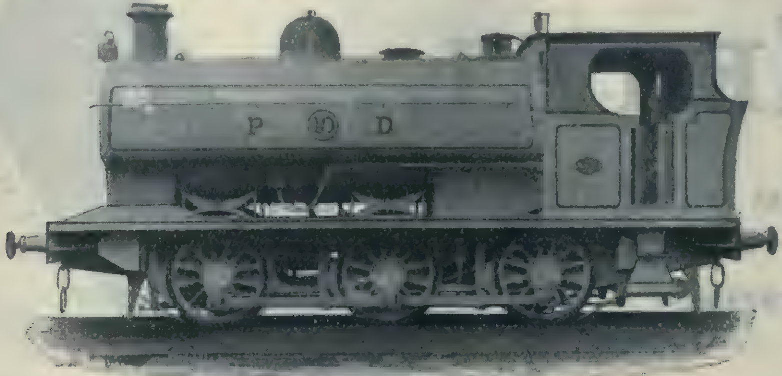

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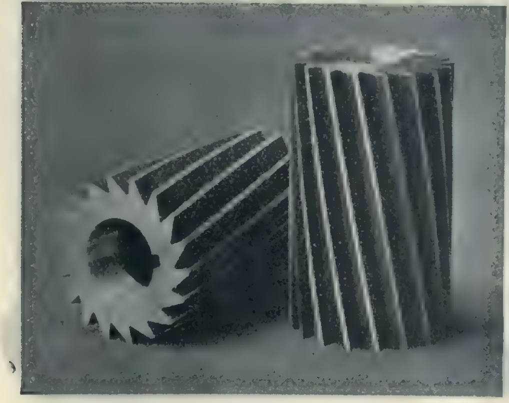

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PAGE'S WEEKLY

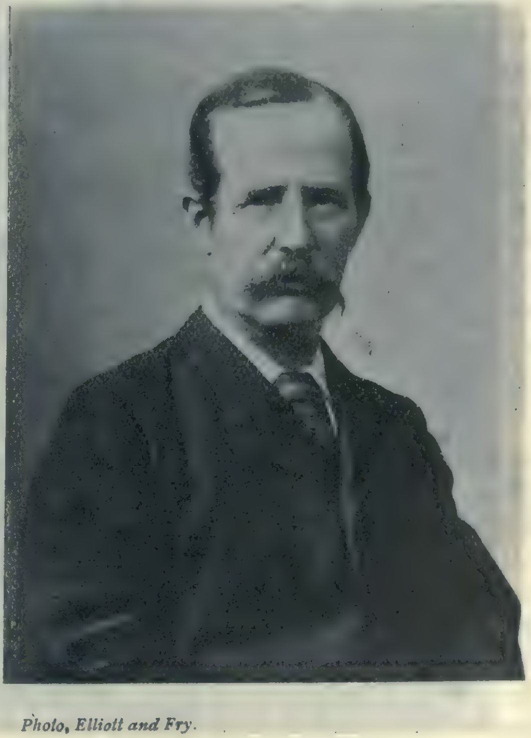
An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, SEPTEMBER 1, 1905. No. 51.

The Offices of "Page's Weekly," Wednesday Evening.

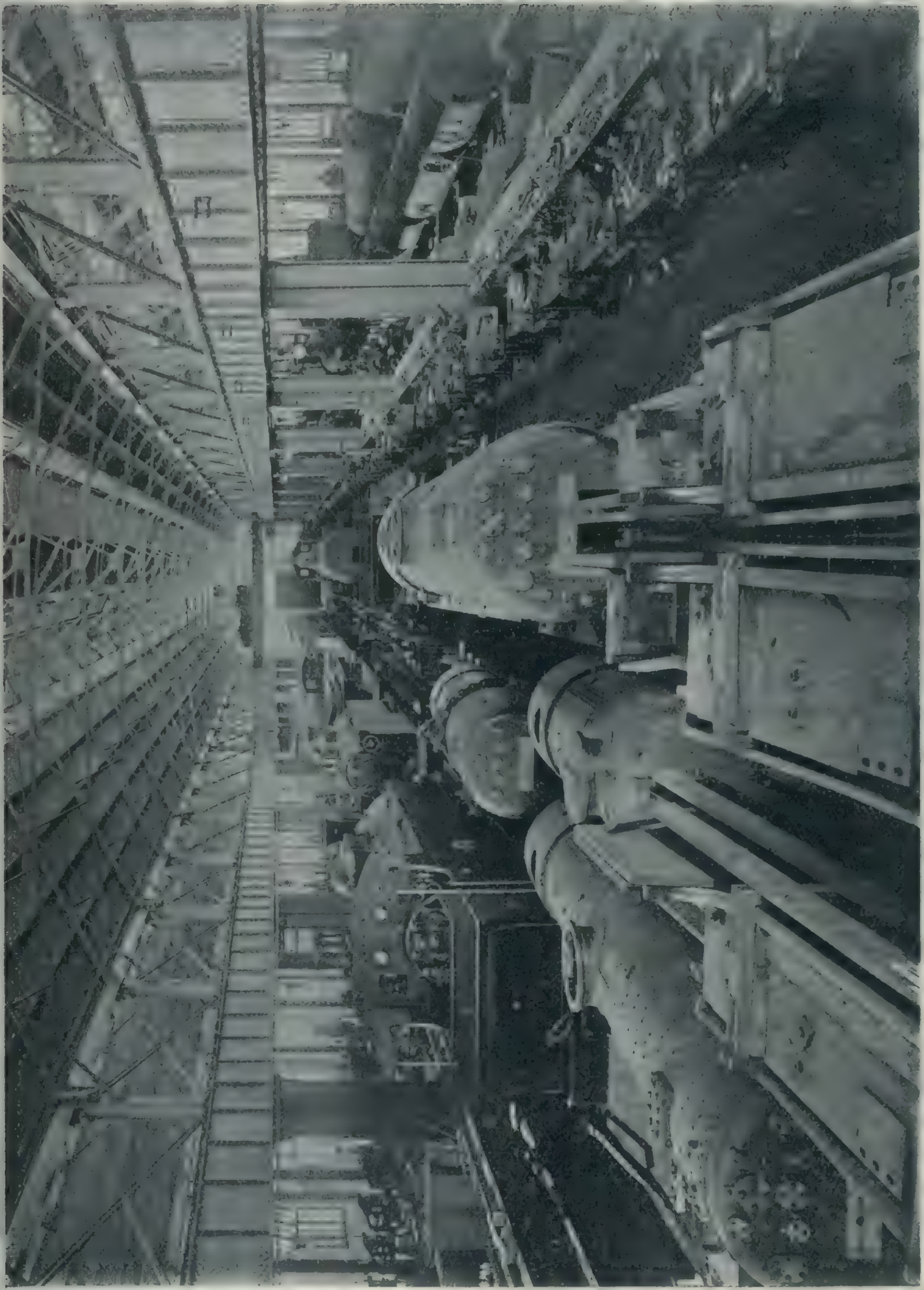
THE cessation of hostilities between Russia and Japan should pave the way to a marked revival of industrial activities. Japan has already furnished abundant evidence that Korea under her influence is to be a progressive country. The peninsula will provide for the surplus population of our Eastern ally, and Japan has shown that Western ideas, involving, *inter alia*, railways, telegraphs and other material falling within the province of the engineer, are necessary to her very existence. With every obstacle which stood in the way of her progress removed, there can be little doubt but that she will forge ahead, and that large contracts for machinery will be forthcoming; indeed it is already reported that Japanese agents have left for America and Europe in quest of railway materials.

Russia just now offers a very different spectacle, but from sheer necessity she too must devote attention to the development of trade and manufactures. Nor is she beyond the power of recuperation. We have heard so many tales of mismanagement and misgovernment that we are apt to overlook the wonderful natural resources of Russia and the finer qualities of the Russians. It would be difficult, of course to hazard a conclusion as to the length of time which will be occupied in restoring to their normal state the industrial concerns which have been paralysed by recent upheavals, but we may fairly assume that, divested of the responsibilities of a harassing war, the Government will devote attention to the home problem with a zeal born instinctively of self-preservation. If they prove themselves capable of learning lessons from the past and setting their



Photo, Elliott and Fry.

SIR C. SCOTT-MONCRIEFF, K.C.S.I., K.C.M.G., President of the Engineering Section, British Association. (*See page* 464.)



NATAL GOVERNMENT RAILWAYS, LOCOMOTIVE, CARRIAGE AND WAGON DEPARTMENT AT DURBAN.

THE ERECTING SHOP. (*See page* 458.)

discredited house in order, a new era of exceptional prosperity for Russia may date even from the conclusion of the war.

The total production of pig-iron in Russia in 1904, as given in the annual statistical report of the British Iron Trade Association, was 2,885,400 tons, of which 1,784,000 were produced in the south, 644,000 tons were produced in the Oural, and the rest was produced in other parts of the empire, including Poland. The following figures present the official details of production, so far as returns have been made: Pig-iron: Foundry iron, 451,500 tons; forge iron, 1,481,400 tons; not described, 845,300 tons; furnace castings, 46,000 tons; spiegel, 12 to 14 per cent., 1,600,000 tons; spiegel, 19 to 20 per cent., 31,700 tons; ferro-manganese, 58 to 60 per cent., 11,000 tons; ferro-manganese, 78 to 80 per cent., 8,000 tons; ferro-silicon, 10 to 12 per cent., 8,900 tons; total, 2,885,400 tons.

The quantities of steel, etc., produced in 1904 have been as under: A Products: Bessemer acid ingots, 488,000 tons; Bessemer basic ingots, 165,000 tons; open-hearth ingots, 2,041,000 tons; puddled bars, 213,000 tons; crucible ingots, 6,000 tons; bars from refinery, 28,000 tons; total, 2,941,000 tons. B Products: Castings from cupolas, and from reverberatory furnaces, 202,000 tons; castings from open-hearth furnaces, 55,000 tons; pipes of cast-iron for water, etc., 32,000 tons; other pieces, 550 tons; total, 289,550 tons. No. 3 Products: Blooms, billets, etc., for sale, 150 tons; girders, not above 100 mm., 149,000 tons; rails for tramways, 3,700 tons; rails for steam railways not weighing more than 8·32 lb. per foot, 395,000 tons; rails for mines above 8·32 lb. per foot, 19,000 tons; merchant iron not specially indicated, 885,000 tons; steel for general purposes, 10,000 tons; steel for tools and implements, 3,000 tons; cementation steel, 105 tons; total, 1,614,805 tons.

The output of the Russian Empire in some other leading products was as under: Pipes 13,397 tons; tubes for boilers, 392 tons; pipes welded for boilers, 18,182 tons; boilers, general, 1,923 tons; boilers for locomobiles, 21 tons; boilers for locomotives, 6,888 tons; fish plates, 75,830 tons; bolts and spikes, etc., 32,660 tons; drawn wire, 40,800 tons; wire nails, 24,000 tons; wire products, 600 tons; wagon wheels, 10,000 tons; locomotive wheels and axles, etc., 8,921 tons; wagons, 65,874 tons; carriages, 11,870 tons; locomotives, 54,820 tons. The total stock of pig-iron throughout the empire at the end of 1904 was reported at 732,000 tons, of which 121,000 tons were in the South of Russia; 378,000 tons in the Oural, 72,500 tons in Poland, and the remainder was held on the Volga, on the Black Sea, on the Baltic, and in the North. The consumption of both iron and steel in Russia has been declining during the last few years. The maximum consumption was reached with 3,677,341 tons of pig-iron—including imports to the extent of 136,000 tons— in 1899, while in 1903 the consumption—including only 13,595 tons imported—had fallen to 2,803,829 tons. In these figures the finished steel, machinery, etc., imported is reduced to term of pig-iron. Nevertheless, by means of the highest scale of tariff duties in Europe, Russia is steadily reducing her imports of iron and steel, and leaving the domestic market almost entirely in the hands of home producers.

The Isham shell, which was tested a few days ago at Sandy Hook against an 11½ steel Krupp plate, was designed on the theory that, if a projectile charged with high explosive be burst by impact against the outside of armour plate, it will produce the same destructive effects that are secured when a high explosive shell is carried through the armour and burst within the interior of the ship or fortification. The shell, which was fired from a 12-in. gun, contained 178¼ lb. of explosive made up of 90 per cent. nitro-glycerine, 8 per cent. gun-cotton, and 2 per cent. camphor, the last-named acting as a deterrent. It was 59 in. long and was divided into ten compartments separated by circular diaphragms. The charge was 82 lb. 10 oz. of smokeless powder and 7 lb. of igniting charge. The missile merely "dished" the face of the armour a few inches inward, and the target was driven in several inches.

Captain Piorkowski, an officer in the German army and now connected with the Krupp works, who was among those present at the firing, said: "The result was to have been expected with almost positive assurance. If the target had, in fact, been a battleship, the impact of the Isham shell would have done no serious damage. The fact that the target was driven in 3 in. to 5 in. is of no importance. It was an isolated plate. If it had been the plate of a battleship, built solidly into the other plates, the elasticity of the ship and the fact that she would have been forced sideways a trifle by the force of the explosion, would have saved her from serious harm. The result is no surprise to ordnance experts of all nations, who have become satisfied that the only practical shell is one that will pierce a vessel's armour plate and explode on the inside." Mr. Isham, however, is of opinion that much of the force of the powerful gases released by the explosion drifted over the low top of the target, and he is anxious to have another test of his shell with a target resembling the side of a battleship.

There is much, says a mining contemporary, that is somewhat mysterious about the explosion of nitro-powders, gun cotton and other high-grade explosives, but it is agreed by all careful observers that when nitro-powder is surrounded by a medium such as air, water or rock, the explosive force is exerted equally in all directions, but manifests itself chiefly in the direction of the least resistance. That is, if a blast is fired in a drill hole the gases formed by the explosion, in their efforts to escape, will tear away a portion of the rock surrounding the drill hole. When dynamite is placed on top of a rock it will shatter the rock if it be not too large. If the same amount of powder is placed under the rock, and in contact with it, it will also shatter the rock, showing that the explosive force is exerted in an upward as well as in a downward direction. The impression that many have that the explosive force of nitro-glycerine and dynamite is downward only is erroneous.

From the revised programme, which appears on page 469, it will be seen that the Iron and Steel Institute Sheffield meeting promises to be a highly successful function. The venue on this occasion is a particularly suitable one, owing to the fact that the president of the Institute, Mr. R. A. Hadfield, will be able to welcome visitors in his own city. The steel works in Sheffield and the neighbourhood are being freely thrown open for the inspection of visitors, and with the assistance of Mr. Bennett H. Brough—"the incomparable secretary"—as he was termed at the last meeting of the Institute, the outdoor programme has been rendered so attractive that an unprecendented attendance of ladies is anticipated. A meeting of the committee appointed to arrange for the reception of the Institute was held recently, Colonel Hughes presiding, when it was stated that applications to participate in the visits to works were so numerous that it would be physically impossible for the proprietors to make proper arrangements for all who wish to go round. The committee, therefore, came to the conclusion that it will be necessary for local members of the Institute in most instances to waive their claim to take part in the visits.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

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Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Six Japanese railway representatives have, says the Standard, arrived at Chicago, en route for England and Europe. They will purchase supplies to the value of £6,000,000, chiefly from the United States and England.

The contract for 43,000 tons of steel required for the Manhattan bridge has been awarded to the Pensylvania Steel Company.

Charles M. Schwab, president of the Bethlehem Steel Company, sailed on the *Kaiser Wilhelm der Zweite* for Europe on the 15th ult.

It is announced that China has cancelled the rights and concessions of the Canton-Han-kau Railway, and will pay an indemnity of $6,750,000 (£1,350,000) to the American China Development Company.

Sir Alexander R. Binnie, has taken up his residence at Bircort Lodge, Toome, where he will remain for the next two months investigating the causes of the flooding of the area surrounding Lough Neagh, and the best methods to be adopted to remedy the evil.

We are glad to be able to state that the alarming reports circulated in the press regarding the health of Mr. C. T. Yerkes have been very much exaggerated. It is true that Mr. Yerkes has been much indisposed, and that he is at present recuperating on the Continent, but we are informed that he has never been seriously ill. On Wednesday a wire was received in London, stating that he expects to be able to return to town in a fortnight.

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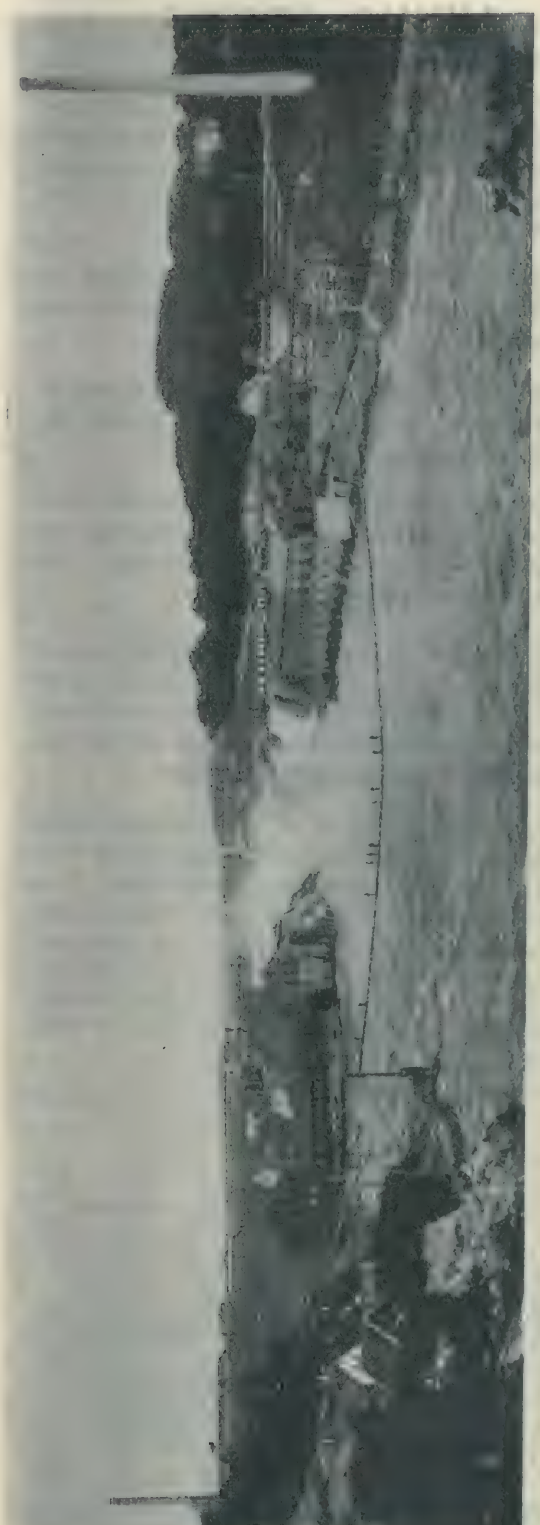


419 FT. SPAN FOOTBRIDGE AT SARPS FALLS, NORWAY.

A 419 ft. Span Footbridge.

The accompanying view shows a large industrial plant at the Sarps Falls, near Sarpsborg, Norway, with, in the foreground, a footbridge, having a free span of no less than 419 ft. The material used was 100 single coiled wires, seven made especially for the purpose, and of an exceptionally good quality. A capacity of 8,000 lb. was required, but its breaking strength lies somewhere near 30,000 lb. As these bridges are both cheap and strong, they have found quite a vogue in Norway, and Mr. Ulrik Rosing, who designed the bridge illustrated, informs us that he has erected more than a dozen during the present year.

Midland Counties Institution of Engineers.

The annual meeting of the Midland Counties Institution of Engineers will be held at Nottingham University College to-morrow. Previous to the meeting an excursion will be made to the bore-hole at Oxton, near Nottingham, where the Calyx system of boring is in operation. Subsequently, a paper, entitled "A New Spark-preventer for Locomotives," by Mr. W. Maurice, will be read and discussed. The president proposed for the year 1905–6 is Mr. W. G. Phillips.

Sir C. Scott-Moncrieff's Address.

The presidential address of Sir C. Scott-Moncrieff to the engineering section of the British Association was in our hands several weeks ago, but only on the distinct understanding that it should not be published before delivery. It was delivered on Tuesday in Johannesburg, and consequently a report appears in our columns to-day. We make this observation in justice to ourselves, as the condition does not appear to have been universally observed.

Tin Mining in Cornwall.

It is stated that a syndicate has been formed to re-work the Wheal Eliza and Buckler's Tin Mines, and to work and develop adjacent tin and other mineral property in St. Austell, Cornwall. A company for the reworking of the Great Dowgas tin mines, near Sticker, St. Stephens-in-Branwell, is also reported to be in process of formation.

"Advertising Engineers."

An American contemporary chronicles the formation of a new concern, the proprietors of which will be known as "Advertising Engineers." The object of the company is the presentation, for promoters of new things of value in the engineering trade, of those devices and improvements which experience has shown need advertising to bring them into commercial success within a time compatible with their engineering value,

Packing Machinery for Export.

Mr. Paul Roux, a member of the American Chamber of Commerce at Paris, in the course of a paper entitled "The Packing of Machinery for Export," remarks that projecting parts should be removed and packed separately. They increase space and increase risks of breakage. The parts should be so marked as to absolutely preclude the possibility of error. Herein will be found more than half the success of securing foreign trade. Merchants and manufacturers should look carefully into the matter of weights and measures. They mean much in the questions of trade. Rates are often regulated on the weight basis.

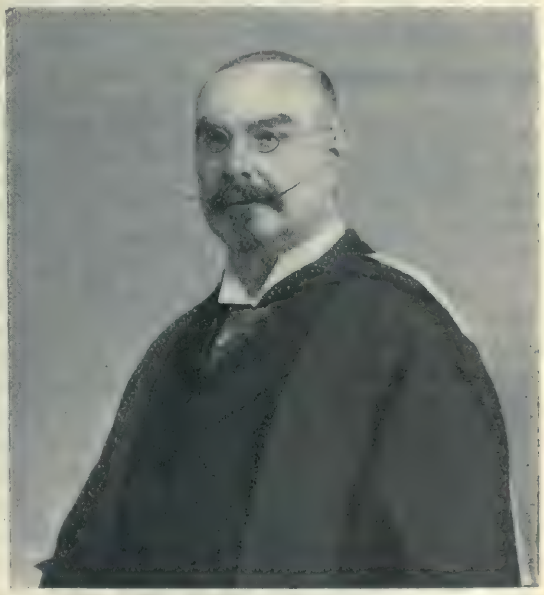
Large and heavy bales increase the costs of loading and unloading. Care should be taken to permit of easy and efficient examination of the machine or parts packed, even to the admission of a lantern to reveal the parts. For this purpose it is a good plan to fasten one side of the case with screws, usually the side that permits of the best examination. Every box should be accompanied by its own list of pieces, and, when possible, by drawings of the parts and the complete machine. This helps the adjusters. It is not a bad idea to send with each machine any particular or peculiar tool that may be found useful or helpful in adjusting the parts. Next in importance to marking the parts of the machines is the marking of the cases. It should indicate the weight, gross, net (absolutely exact), volume, and port of destination, the latter in large letters, at least 2 in. long. Marks of identification on each end of a case are of great value. A mark of some kind should surround the heads of nails or screws, which should be removed to unpack the machine.

Tyne, Wear, and Tees Shipbuilding.

According to the Glasgow Herald, the North Country shipbuilding yards show a fair amount of work in hand, still there is plenty of room for more, including the engine works of the district. Messrs. Doxford and Sons, Ltd., Sunderland, show a bold front in the turret steamer building line, and have orders on hand, it is said, which will carry them well over next year. In this particular class of boat we hear of a new departure, patent rights for which are likely to be applied for shortly. Then, again, it is rumoured that the day is not far distant when turbine engines may be seen in new cargo-carrying steamers. It is calculated that the extra cost, including a bigger coal consumption, can be more than covered through more voyages over a period. Messrs. Hawthorn, Leslie and Co. are about to introduce new machinery for the purpose of developing the building of turbine engines for steamers. Apart from the Neptune-Furness deal in new tonnage, it is announced that Messrs. Holman and Co., London, have placed an order for a 7,100-tonner with Messrs. W. Gray and Co., West Hartlepool, the price of which is stated to be near £41,000. Another big boat, 7,300 tons, has to be constructed by Messrs. Richardson, Duck and Co., Stockton-on-Tees, to the order of Messrs. Gunn and Co., Cardiff, and to be engined by Messrs Blair and Co., of the same place. Further, it is stated that Messrs. Steel, Young and Co., London, have contracted with Messrs. R. Stephenson and Co., Newcastle, for a boat with a carrying capacity of about 6,000 tons on a 21-ft. draught of water, to be engined also by Messrs. Blair and Co. The Northumberland Shipbuilding Company, Howden-on-Tyne, are credited with an order from Messrs. Houlder, Middleton and Co., London, for four cargo boats, each to be about 7,000 tons deadweight capacity.

Large Order for Locomotives.

The New York Central has placed an order for thirty-five electric locomotives, to haul the through trains of the system into New York City, and 175 cars to be used in the suburban service. The engines are to be built by the General Electric Company and the American Locomotive Company at Schenectady, New



Photo, Elliott and Fry.

SIR ALBERT KAYE ROLLIT, M.P.

Chairman of the International Exhibitions Committee of the London Chamber of Commerce. (*See page* 488.)

York, and are to be ready by August 1st, 1906. Each engine will weigh about 100 tons, having eight driving wheels with a diameter of 44 in. a piece, and will develop 2,200 h.p. For short distances this power can be exceeded.

The Rating of Machinery.

The Secretary of the London Machinery League calls attention to the diversity of practice which exists among local authorities in assessing machinery for rates. Where the local authorities are sympathetic towards industrialism the taxation is either low or not levied at all, but in other places the rating is so grievous as seriously to hamper trade. With a view of obtaining a modification of the present unfair laws, and of securing uniform action throughout the country, the London Machinery League was organised, and it invites the co-operation of provincial manufacturers in the work of agitating for the reforms in question. Briefly stated the League would revert to the total exemption policy of 1840, plus the condition that machinery attached to the building and necessary to its first equipment should be rated. It would place the law above the operation of local caprice and prejudice. In this policy it has the support of the Royal Commission on Local Taxation, which would exempt from assessment machines, tools, and appliances "not fixed or only so fixed that they can be removed from their place without necessitating the removal of any part of the hereditament."

Railway Electrification.

The electric train service between Ealing and Whitechapel has been projected to East Ham. The District Railway ends at Whitechapel, and the service inaugurated is one in the interests of the Tilbury and District Companies, from stations on the District Railway, working over the Whitechapel and Bow the joint property of the two companies) to Bromley, thence to East Ham over the Tilbury and Southend line. This service will be extended to Barking as a terminus so soon as the alterations at that station are completed. It is announced that the service between Whitechapel and Wimbledon will be electrified within the next few days. When the Wimbledon steam trains are removed one part of the Circle—from Earl's Court to the Mansion House—will be electrified, with the exception of the half-hour service of London and North-Western trains and the Inner Circle trains. In a very short time the North-Western trains will be hauled between Earl's Court and the Mansion House by electric locomotives. So far as the Metropolitan Railway is concerned its electrified services is at present confined to its own metals between South Kensington and Aldgate, the District Railway having declined to permit "Circle" running until certain modifications in the electrical equipment of the Metropolitan trains have made them, in the opinion of the District management, adaptable to the latter's conductor rail. These alterations are so far completed, says the Standard, that next month this obstacle to the "Circle" service of electric trains will have been removed. It may be stated with certainty, however, that the Metropolitan's "shuttle" service of electric trains over its own part of the "Circle" line will shortly be considerably augmented.

Production of Fluorspar.

While the demand for fluorspar has increased greatly in the last two years as a result of its use in foundry work, Illinois and Kentucky continue to be the chief sources of supply. As is well known fluorspar is used in glass making and in foundry operations because of its silica. In 1904, says the Iron Trade Review, the production of fluorspar amounted to 36,452, short tons. valued at $234,755. As compared with the production of 1903 this is a decrease from 42,523 short tons produced in that year, of over 6,000 tons but the value thereof increased $21,138. The increased value of the production was largely due to the form in which it was sold in 1904. The following is a table showing the production of fluorspar by States in 1902, 1903, and 1904:—

State.	1902. Quantity. Snort tons.	1902. Value. $	1903. Quantity. Short tons.	1903. Value. $	1904. Quantity. Short tons.	1904. Value. $
Arizona and Tennessee...	628	6,872	275	2,037	151	1,084
Kentucky......	29,030	143,410	30,835	153,960	19,006	111,499
Illinois	18,360	121,532	11 413	57 620	17,205	122,172
Total	48 018	$271,814	42,523	$213,617	36,452	$234,755

Though the production in 1904 has plainly fallen off considerably from that of 1902 and 1903, it was still much greater than the production previous to the last few years.

The Canadian production of pig-iron in the first half of 1905, was the greatest in any half-year in the history of the Dominion, exceeding by 48,453 tons that of the last half of 1902, the next highest half year, when 161,753 tons were made.

The Secretary of the Labour Representation Committee, Mr. J. Ramsay Macdonald, proposes the organisation of an Imperial Labour Conference. Three representatives labour leaders would be selected to visit the Colonies in turn, and one of the objects of the conference would be to bring the labour forces of the empire into line with each other.

THE CARE OF MOTORS.

THE fact that dynamos and motors need very little attention, says Mr. A. H. Bate, A.M.I.E.E., in his excellent treatise on the "Principles of Electrical Power (continuous current)"* has led some engineers to treat them as if they required no attention at all, yet it is recognised by all who have had experience of the working of an electrical power plant that nothing is so likely to cause breakdowns as dirt and neglect.

Mr. Bate enumerates the following points which can be looked to while the motors are running:—

1. Lift the oil covers and notice that the rings are running freely and picking up the oil properly. If they run so fast that the oil is spattered off, it shows that there is not enough oil in the well. Do not add a little oil at every inspection unless the gauge shows that it is below the proper level, but drain all the dirty oil out and fill with clean every month or two.

2. Notice whether any oil is entering the motor; if so stop the machine and wipe it up at once, and if possible find the cause and remedy the defect without delay. Do not let oil fall on the cables, as it rots most kinds of insulating materials.

3. Clean the commutator by holding a piece of clean rag against it while running. If the commutator is very dirty, moisten the rag with methylated spirit, or if oil has got to the commutator use the least possible trace of paraffin. Do not use cotton waste for this purpose, as the fluff gets drawn into the machine. If the motor is working without any sparking, the surface of the commutator will be polished to a deep blue colour, but if there has been sparking it will be shown by the blackening of the edges of the segments next the mica. If the sparking has been serious enough to roughen the commutator it will have to be cleaned with fine emery cloth, but if the sparking is a thing of the past, and the motor is working properly at the time of examination, it is best to clean with the rag and let it run on for a few days in the hope that it may acquire a natural polish by the friction of the brushes. If the surface is too rough for this, press a piece of the finest emery cloth (F.F. quality) against the commutator while running. Do not use sand paper, except when copper brushes are employed, and avoid coarse grades of emery cloth, as they wear the copper and mica unevenly and cause flats.

When the current is switched off, the following points can be attended to:—

1. Lift the brushes one by one and see that each is pressed against the commutator with the proper tension.

2. Renew any brushes that are worn too short.

3. Clean all dust or dirt from the rocket gear, paying special attention to the insulating parts.

4. Wipe over all the internal parts of the machine that are accessible, and, say once a month, blow the dust out of the commutator risers with a clean pair of bellows.

5. See that the nuts and screws of the terminals, etc., have not worked slack with the vibration.

6. If the contact studs of the starting switch, or the blades and jaws of the main switch, are seared by arcs, clean them with emery cloth backed with an old file, or a piece of wood.

7. Clean the contacts of the overload release on the starting switch occasionally.

8. Once or twice a year take out the fuses (if they have not been renewed in the meantime) and clean the contact surfaces.

Mr. Bate's work is especially intended for mechanical engineers, and forms one of the Finsbury Technical series of manuals, edited by Professor Silvanus P. Thompson. It is written in a style that will appeal essentially to engineers who have commenced practice ten or twenty years ago, and have not had the opportunity of making a systematic study of electrical engineering, and it should also be in great demand by students who require to obtain quickly the fundamental facts connected with the behaviour of currents and motors. It is concerned with the production, control, and use of electricity in its practical aspect, and the descriptions given are so clear, that the work cannot fail to be of value to the purchasers of motors and manufacturers who are brought face to face with problems involving the electric driving of machinery. It may be mentioned, that a whole chapter is devoted to electrical driving, a number of tables setting forth the horse-power absorbed by various machines.

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* E. and F. N. Spon, Ltd.

THE DEVELOPMENT OF THE LOCOMOTIVE DEPARTMENT OF THE NATAL GOVERNMENT RAILWAYS.

BY SIR DAVID HUNTER, K.C.M.G.

IT is perhaps noteworthy that the first railway on the continent of Africa was made in Natal in the year 1864; the line running from the Point to the town of Durban, a distance of two miles, which was afterwards extended to Umgeni, in all six miles. The enterprise was known as the Natal Railway Company.

On New Year's Day, 1876, Sir Henry Bulwer, at that time Lieutenant-Governor of the colony, turned the first sod of the Government system of railways, and the Natal Railway Company was, a few years later, purchased by the Government for the sum of £40,000. The change of ownership led rapidly to an improvement in its condition and character.

The gauge was reduced from 4 ft. 8½ in. to 3 ft. 6 in. (the standard South African gauge), and the system was furnished with new stock, and was run in a more orthodox and business-like manner.

But this article concerns itself more with the development of the locomotive carriage and wagon department, which to-day, with rolling-stock and up-to-date equipped shops, is second to none in South Africa. The chief works are at Durban, and cover an area of 25 acres. Three years ago it was decided to remodel the workshops, and this work is now in progress.

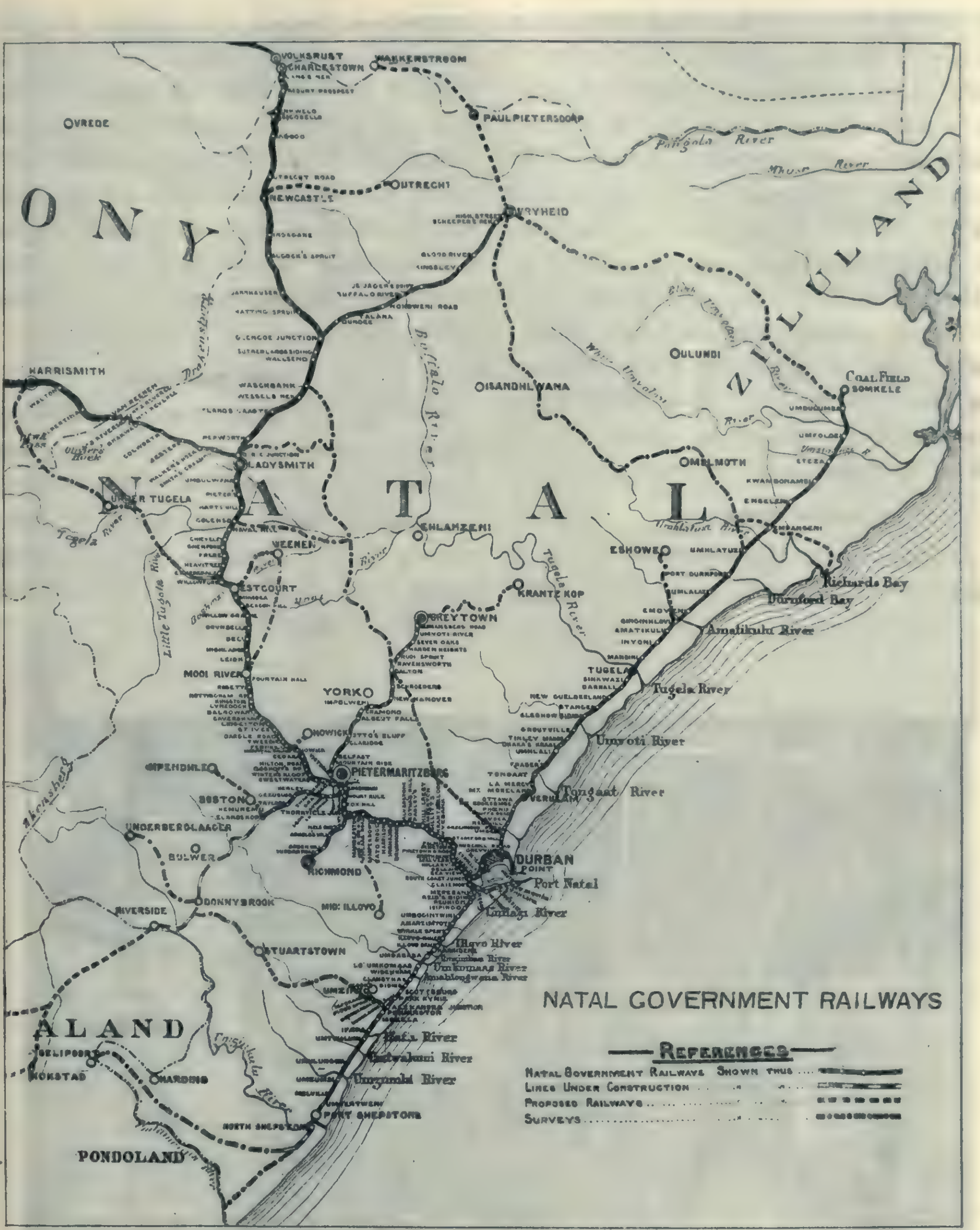
THE LOCOMOTIVE ERECTING SHOP.

This is of recent construction, and is of the most modern design. It consists of two bays 360 ft. long, one bay having a span of 48 ft. 6 in., and the other 47 ft. 3 in.; this space gives accommodation for 38 locomotives. Each bay is equipped with two electric overhead travelling cranes of 35 tons capacity, made by Messrs. Vaughan and Sons. An additional 100 ft. is at present being added to the building, and when this is completed the shop will be in all 460 ft. long, and will give accommodation for 50 locomotives. To the south of the addition is being added a bay of 200 ft. to be used for the erecting of new engines.

LOCOMOTIVE MACHINE SHOP.

This shop is also of recent construction, and consists of one bay 360 ft. long, having a span of 47 ft. 3 in. The design of this building is similar to the locomotive erecting shop, with an electric travelling crane of 5-tons capacity, made by Messrs. Vaughan and Sons. The progress of the railway has also compelled the management to further extend this shop, and at present another two bays of 80 ft. are being added. The shop contains six double-face plate wheel lathes, six patent emery wheels, one rotary grinder, one patent side planer, 22 vertical drills, 3 radial drills, 11 surfacing and boring lathes, 42 sliding surfacing and screw-cutting lathes and three screwing machines, eight patent turret lathes, five hollow spindle lathes, and many other tools for special work.

In addition, the shop for brass work will contain a full complement of lathes, milling



and shaping machines specially constructed to deal with brass finishing.

BOILERMAKERS' SHOP.

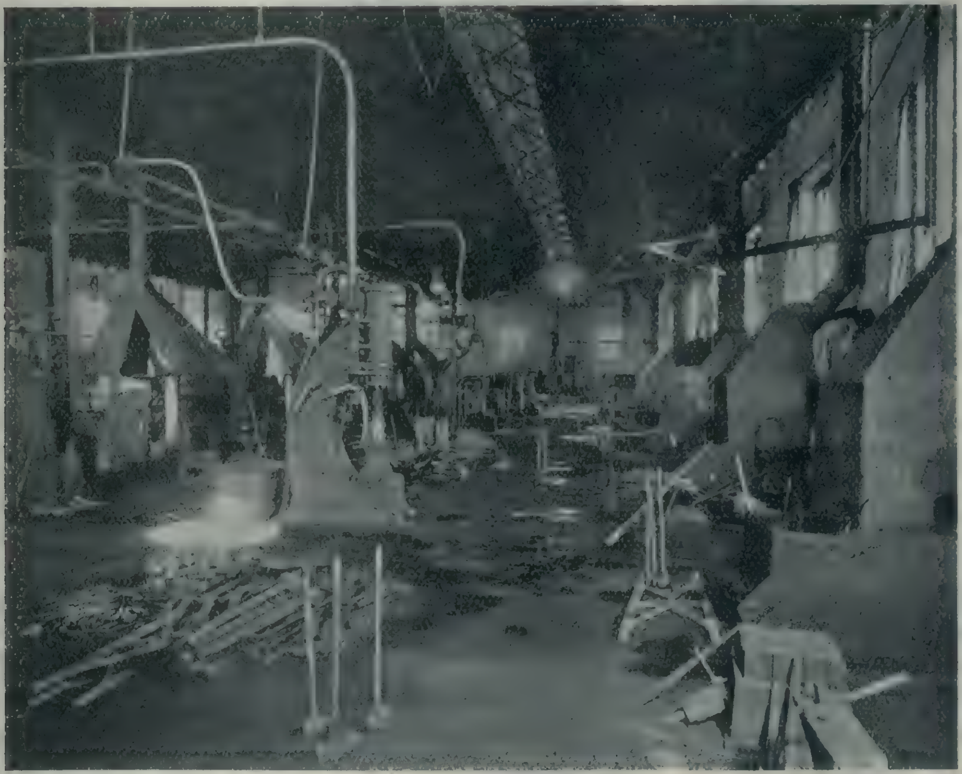
This important department is at present in a state of transition. The old shops, which have done good service, are being pulled down, and a new shop of larger capacity is being erected. This will enable the management to add to their facilities, and also to cope with the necessary demands made upon the department. The new shop, when completed, will have four bays each of 100 ft. long, with a span of 48 ft. 6 in., giving a floor space of 194 ft. by 100 ft. The building, which is a continuation of the locomotive erecting and machine shops, is of the most modern design, and when completed it will contain a modern installation of hydraulic plant, accumulator pumps, flanging presses, riveters, etc.; also an up-to-date pneumatic plant with necessary caulking tools, hoists, drill, etc. This shop is so situated that the 35-ton electric cranes used in the locomotive and machine shops can be utilised to carry the boilers direct from the boiler shops to the engine frames. The machinery equipment will consist of large punch and shearing machine, plate-bending rolls, radial drills, multiple vertical drill, and other machine tools, in addition to cranes and riveters.

SMITH SHOP.

The existing smith shop contains 33 fires five single steam hammers, a 20-cwt. double legged steam hammer, a patent pneumatic hammer, a modern bolt-making machine, etc. Owing to the rapid development of the department, it has been found necessary to extend the premises, and it is intended to make an addition which will include the spring smiths and forge. About 30 fires will be added, and the new forge will be equipped with all modern appliances; a special boiler will be placed over the furnaces, so that the waste heat may be utilised for generating steam.

IRON FOUNDRY.

The existing foundry has a floor space of about 340 square feet, and is equipped with two cupolas, two overhead travelling cranes, also core-making shops, core-drying stoves, and dressing shops. Owing to the increasing demands made by almost every department of the railway on this section of the works, it has



SMITH SHOP AT THE DURBAN WORKS.

NEW CARRIAGE ERECTING SHOP.

THE MACHINE SHOP.

ELECTRIC TRAVERSER RUNNING THE FULL LENGTH OF THE EXTERIOR OF THE CARRIAGE SHOP.

been decided to make considerable alterations and additions to enable the foundry to cope with them, and also to make adequate provision for the future. When these additions and alterations are completed, the accommodation will be considerably greater than at present. New cupolas of larger dimensions are to be erected and equipped with hydraulic hoists for conveying the pig-iron on to the charging floors; modern plant, in the shape of geared crane ladles, sand and coal-dust grinding mills, additional drying stoves, moulding machines, etc., will also be supplied to the department, which will enable the work to be done more rapidly and economically.

PATTERN SHOP.

This department is building, the upper portion being utilised as a pattern store. The workshop on the ground floor is equipped with two turning lathes, band and circular saws, patent wood trimmers, etc. The pattern-makers' benches are fitted with Emmot's patent vices.

COPPER SMITH SHOP.

This shop is a large and airy building, which is necessary, considering the class of work executed; it is fitted with all necessary plant for rapid production of work.

TINSMITH SHOP AND BRASS FOUNDRY.

One half of this building is used as a brass foundry and the other as a tinsmith shop. The latter is equipped with full complement of plant, such as circular cutting machines, guillotine square machine, oil can spout forming machines, etc., for the rapid production of tinsmith and plumbing work. All the locomotive head lamps, station lamps, etc., are made and kept in repair in this department. The upper portion of the shop is used for the storage of material, etc.

The brass foundry is a large and commodious shop replete with modern appliances. It contains nine fires, and plant for making metallic packing, one magnetic separator, modern core stoves of ample capacity, etc.

WHEEL SHOP.

Owing to hilly country, steep grades, and heavy curves, the running gear of the rolling stock demands very close attention. The present shop is not in a position to execute the necessary repairs in an up-to-date manner, and to overcome the difficulty it has been decided to build a new shop to deal more effectively and rapidly with wheel repairs. It is proposed that the new shop shall be formed of two bays 396 ft., each bay having a span of 47 ft., and when completed will contain eight double-face plate wheel lathes, four wheel boss boring and turning lathes, three axle turning lathes, and one axle journal turning and grinding machine, two hydraulic wheel presses, and numerous other small tools for this class of work. In addition to these machines (which, by the way, will all be made for high speed tool steel), modern furnaces and quick acting hydraulic crane and overhead electric travelling cranes will also be added.

WAGON REPAIRING AND UNDER-FRAME SHOP.

The present wagon shop is far too small for the work which has to be executed, but thanks to the climate of the garden colony, the larger part of this work can be done in the open. A new shop is, however, under consideration—a building of three 47-ft. bays, 396 ft. long, which will be equipped with modern plant for repairs to all classes of steel wagons and the building of underframes for new carriage stock.

CARRIAGE ERECTING SHOP.

This shop has been recently completed, and consists of one bay 396 ft. with a span of 47 ft., and, in the near future, it is proposed to add another two bays. It is of the most modern design, and embodies all the essential requirements in the shape of space, ventilation, light, etc., to make it thoroughly suitable for a semi-tropical climate. It is equipped with a 10-ton overhead electric travelling crane. It is intended to devote this building especially to the erecting and building of new stock. The carriage repair shop is part of the older portion of the works, and consists of three bays of 40 ft. span and 292 ft. long. This building is now used entirely for carriage repairs and paint shops. One end, formerly used as a saw mill, will be converted into additional repair accommodation, as it is required in consequence of the increased demand for stock.

The carriage trimming shop is situated in the upper storey of this building, and is an airy and commodious workshop and capable of accommodating thirty to forty coach trimmers.

An electric traverser runs the full length of the exterior of the carriage shop, and is constructed to convey to any bay the largest carriages, which measure 60 ft. over body and weigh 32 tons.

SAW MILL.

This shop, which runs alongside the new carriage-building shop, had one bay 396 ft. and span 47 ft.; it contains one 5-ton overhead electric travelling crane, with the following machines of the most modern design, viz.:—

A large vertical log and deal saw frame, a suspended swing cross-cut saw, four circular saws, two band saws, a large planing and moulding machine, two rebating saws, four mortising machines, a general joiner, a surfacing machine, two panel planing machines, two tenoning machines, two double spindle machines, a single spindle machine, a rounding machine, a turning lathe, a blind or louvre mortising machine, and other sundry tools for saw sharpening, plane iron grinders, etc.

All these appliances are driven by separate electric motors, with the exception of seven of the smaller tools, which are driven from a main shaft worked by an electric motor.

The sawdust, chips, etc., will be removed by means of suction through pipes conveyed to boilers to be used as fuel.

(*To be continued.*)

THE BRITISH ASSOCIATION IN SOUTH AFRICA.

ADDRESS TO THE ENGINEERING SECTION.

By Colonel Sir C. Scott-Moncrieff, K.C.S.I., K.C.M.G. (President).

THE President commenced by announcing that his address would be confined to a single branch of engineering, viz., the science of irrigation, which has occupied the best years of his life in India, Southern Europe, Central Asia, and Egypt. After some preliminary remarks on the meaning of "Irrigation" and primitive methods of effecting it, he proceeded as follows :—

PUMPS AND WINDMILLS.

Egypt has of late been more in touch with Western civilisation, and since its cotton and sugar-cane crops yield from £6 to £8, or even £10 per acre, the well-to-do farmer can easily afford a centrifugal pump worked by steam power. Of these there are now many hundreds fixed or portable working on the Nile banks in Egypt. Where wind can be counted on the windmill is a very useful and cheap means of raising water. But everything depends on the force and the reliability of the wind. In the dry Western States of America wind power is largely used for pumping. If is found that this power is of little use if its velocity is not at least six miles per hour. (The mean force of the wind throughout the whole United States is eight miles per hour.) Every windmill, moreover, should discharge its water into a tank It is evident that irrigation cannot go on without cessation day and night, and it may be that the mill is pumping its best just when irrigation is least wanted. The water should, therefore, be stored till required. In America it is found that pumping by wind power is about two-thirds of the cost of steam power. With a reservoir 5 to 15 acres may be kept irrigated by a windmill. Without a reservoir 3 acres is as much as should be counted on. Windmills attached to wells from 30 ft. to 150 ft. deep, cost from £30 to £70.

ARTESIAN WELLS.

Up to now the artesian well cannot be counted on as of great value for irrigation. In the State of California there are said to be 8,097 artesian wells, of a mean depth of 210 ft., discharge ·12 cubic feet per second, and original cost on an average £50. Thirteen acres per well is a large out-turn.

In Algeria the French have bored more than 800 artesian wells, with a mean depth of 142 ft., and they are said to irrigate 50,000 acres. But this is scattered over a large area. Otherwise, the gathering ground would probably yield a much smaller supply to each well than it now has. In Queensland artesian wells are largely used for the water supply of cattle stations, but not for irrigation.

WELL IRRIGATION.

It is evident that where water has to be raised on to the field there is an outlay of human or mechanical power which may be saved if it can be brought to flow over the fields by gravitation. But there is one practical advantage in irrigating with the water raised from one's own well or from a river. It is in the farmer's own hands. He can work his pump and flood his lands when he thinks best. He is independent of his neighbours, and can have no disputes with them as to when he may be able to get water and when it may be denied to him. In Eastern countries, where corruption is rife among the lower subordinates of Government, the farmer who sticks to his, well knows that he will not require to bribe anyone. In India about 13 millions of acres, or 30 per cent. of the whole annual irrigation, is effected by wells. Government may see fit to make advances to enable the farmer to find his water and to purchase the machinery for raising it ; or joint stock companies may be formed with the same object. Beyond this all is in the hands of the landowner himself.

CANAL IRRIGATION.

Irrigation on a large scale is best effected by diverting water from a river or lake into an artificial channel, and thence on to the fields. If the water surface of a river has a slope of 2 ft. per mile, and a canal be drawn from it with a surface slope of 1 ft. per mile, it is evident that at the end of a mile the water in the canal will be 1 ft. higher than that in the river ; and if the water in the river is 10 ft. below the plain, at the end of ten miles the water in the canal will be flush with the plain, and henceforth irrigation can be effected by simple gravitation.

When there is no question of fertilising deposit and only pure water is to be had, the most favourable condition of irrigation is where the canal or the river has its source of supply in a great lake. For, be the rainfall ever so heavy, the water surface in the lake will not rise very much, nor will it greatly sink at the end of a long drought. Where there is no moderating lake, a river fed from a glacier has a precious source of supply. The hotter the weather, the more rapidly will the ice melt, and this is just when irrigation is most wanted.

Elsewhere, if crops are to be raised and the rain cannot be counted on, nor well irrigation be practised, water storage becomes necessary, and it is with the help of water storage that in most countries irrigation is carried on.

WATER STORAGE.

To one who has not given the subject attention surprise is often expressed at the large volume of water that has to be stored to water an acre of land. In the case of rice irrigation in India, it is found that the storage of a million cubic feet does not suffice for more than from 6 to 8 acres. For the irrigation of wheat about one-third this quantity is enough. It would never pay to excavate on a level plain a hollow large enough to hold a million cubic feet of water. It is invariably done by throwing a dam across the bed of a river or a valley and ponding up the water behind it. Many points have here to be considered: The length of dam necessary, its height, the material of which it is to be constructed, the area and the value of the land that must be submerged, the area of the land that may be watered. The limits of the height of a dam are from about 150 ft. to 15 ft. If the slope of the valley is great it may be that the volume which can be ponded up with a dam of even 150 ft. is inconsiderable, and the cost may be prohibitory. On the other hand, if the country is very flat, it may be that a dam of only 20 ft. high may require to be of quite an inordinate length, and compensation for the area of land to be submerged may become a very large item in the estimate. I have known of districts so flat that in order to irrigate an acre more than an acre must be drowned. This looks ridiculous, but is not really so, for the yield of an irrigated acre may be eight or ten times that of an unirrigated one; and after the storage reservoir has been emptied it is often possible to raise a good crop on the saturated bed.

The advantage of a deep reservoir is, however, very great, for the evaporation is in proportion to the area of the surface, and if two reservoirs contain the same volume of water, and the depth of one is double that of the other, the loss by evaporation from the shallow one will be double that of the deep one. In India, from time immemorial, it has been the practice to store water for irrigation, and there are many thousands of reservoirs, from the great artificial lakes holding as much as 5,000 or 6,000 millions of cubic feet, down to the humble village tank holding not a million. There are few of which the dam exceeds 80 ft. in height, and such are nearly always built of masonry or concrete. For these it is absolutely necessary to have sound rock foundations. If the dam is to be of earth, the quality of the soil must be carefully seen to, and there should be a central core of puddle resting on rock and rising to the maximum height of water surface. If the dam is of masonry, there may perhaps be no harm done should the water spill over the top. If it is of earth, this must never happen, and a waste weir must be provided, if possible cut out of rock or built of the best masonry, and large enough to discharge the greatest possible flood. More accidents occur to reservoirs through the want of sufficient waste weirs or their faulty construction than from any other cause.

As important as the waste weir are the outlet sluices, through which the water is conveyed for the irrigation of the fields. If possible they should be arranged to serve at the same time as scouring sluices to carry off the deposit that accumulates at the bottom of the reservoir. For, unless provided with very powerful scouring sluices, sooner or later the bed of the reservoir will become silted up, and the space available for water storage will keep diminishing. As this happens in India, it is usual to go on raising the embankment (for it does not pay to dig out the deposit), and so the life of a reservoir may be prolonged for many years. Ultimately it is abandoned, as it is cheaper to make a new reservoir altogether than to dig out the old one.

ITALIAN IRRIGATION.

For the study of high-class irrigation there is probably no school so good as is to be found in the plains of Piedmont and Lombardy. Every variety of condition is to be found here. The engineering works are of a very high class, and from long generations of experience the farmer knows how best to use his water.

The great river Po has its rise in the foothills to the west of Piedmont. It is not fed from glaciers, but by rain and snow. It carries with it considerable fertilising matter. Its temperature is higher than that of glacial water—a point to which much importance is attached for the very valuable meadow irrigation of winter. From the left bank of the Po, a few miles below Turin, the great Cavour Canal takes its rise, cutting right across the whole drainage of the country. It has a full-supply discharge of 3,800 cubic feet per second; but it is only from October to May that it carries anything like this volume. In summer the discharge does not exceed 2,200 cubic feet per second, which would greatly cripple the value of the work were it not that the glaciers of the Alps are melting then, and the great torrents of the Dora Baltea and Sesia can be counted on for a volume exceeding 6,000 cubic feet per second.

Lombardy is in no respects worse off than Piedmont for the means of irrigation, and its canals have the advantage of being drawn from the lakes Maggiore and Como, exercising a moderating influence on the Ticino and Adda rivers, which is sadly wanted on the Dora Baltea. The Naviglio Grande of Lombardy is drawn from the left bank of the Ticino, and is used largely for navigation, as well as irrigation. It discharges between 3,000 and 4,000 cubic feet per second, and nowhere is irrigation probably carried on with less expense. From between Lake Maggiore and the head of the Naviglio Grande a great new canal, the Villoresi, has been constructed during the last few years with head sluices capable of admitting 6,700 cubic feet per second, of which, however, 4,200 cubic feet have to be passed on to the Naviglio Grande. Like the Cavour Canal, the Villoresi crosses all the drainage coming down from the foothills to the north. This must have entailed the construction of very costly works.

IRRIGATION IN NORTHERN INDIA.

It is in India that irrigation on the largest scale is to be found. The great plains of Northern India are peculiarly well adapted for irrigation, which is a matter of life and death to a teeming population all too well accustomed to a failure of the rain supply.

The Ganges, the Jumna, and the great rivers of the Punjaub have all been largely utilised for feeding irrigation canals. The greatest of these, derived from the river Chenab, and discharging from 10,500 to 3,000 cubic feet per second, was begun in 1889, with the view of carrying water into a tract entirely desert and unpopulated. It was opened on a small scale in 1892, was then enlarged, and ten years after it irrigated in one year 1,829,000 acres, supporting a population of 800,000 inhabitants, colonists from more congested parts of India.

The Ganges Canal, opened in 1854, at a time when there was not a mile of railway, and hardly a steam engine within a thousand miles, has a length of about 9,900 miles, including distributing channels. It was supplemented in 1878 by a lower canal, drawn from the same river 130 miles further down, and these two canals now irrigate between them 1,700,000 acres annually. On all these canals are engineering works of a very high class. The original Ganges Canal, with a width of bed of 200 ft., a depth of 10 ft., and a maximum discharge of 10,000 cubic feet per second, had to cross four great torrents before it could attain to the watershed of the country, after which it could begin to irrigate. Two of these torrents are passed over the canal by broad super-passages. Over one of them the canal is carried in a majestic aqueduct of fifteen arches, each of 50 ft. span; and the fourth torrent, the most difficult of all to deal with, crosses the canal at the same level, a row of forty-seven floodgates, each 10 ft. wide, allowing the torrent to pass through and out of the canal.

Elsewhere there are rivers in India, rising in districts subject to certain heavy periodical rainfall, and carrying their waters on to distant plains of very uncertain rainfall. At a small expense channels can sometimes be constructed drawing off from the flooded river water sufficient thoroughly to saturate the soil, and render it fit to be ploughed up and sown with wheat or barley, which do not require frequent watering. The canal soon dries up, and the sown crop must take its chance; but a timely shower of rain may come in to help it, or well irrigation may mature the crop. These, which are known in India as inundation canals, are of high value.

SOUTHERN INDIA.

In Southern India there are three great rivers, drawing their supply from the line of hills called the Ghats, running parallel to and near the western coast, and after a long course discharging into the Bay of Bengal on the east coast. Against the Ghats beats the whole fury of the tropical south-west monsoon, and these rivers for a few months are in high flood. As they approach the sea they spread out in the usual deltaic form. Dams have been built across the apex of these deltas, from which canals have been drawn, and the flood waters are easily diverted over the fields, raising a rice crop of untold value in a land where drought and famine are too common. But for the other months of the year these rivers contain very little water, and there is now a proposition for supplementing them with very large reservoirs.

A very bold and successful piece of irrigation engineering was carried out a few years ago in South India, which deserves notice. A river named the Periyar took its rise in the Ghats, and descended to the sea on the west coast, where there was no means of utilising the water, and a good deal of money had periodically to be spent in controlling its furious floods. A dam has now been built across its course, and a tunnel has been made through the mountains, enabling the reservoir to be discharged into a system of canals to the east, where there is a vast plain much in need of water.

In the native State of Mysore, in Southern India, there are on the register about 40,000 irrigation reservoirs (or tanks, as they are called), or about three to every four square miles, and the nature of the country is such that hundreds may be found in the basin of one river—small tanks in the upper branches and larger ones in the lower, as the valley widens out, and these require constant watchful attention. From time to time tropical rainstorms sweep over the country. If then even a small tank has been neglected, and rats and porcupines have been allowed to burrow in the dam, the flood may burst through it, and sweep on and over the dam of the next village, lower down. One dam may then burst after another, like a pack of cards, and terrible loss occurs.

In this State of Mysore a very remarkable irrigation reservoir in now under construction at a place called Mari Kanave. Nature seems here to have formed an ideal site for a reservoir, so that it is almost irresistible for the engineer to do his part, even although irrigation is not so badly wanted here as elsewhere. The comparatively narrow neck of a valley cantaining 2,075 square miles is being closed by a masonry dam 142 ft. high. The reservoir thus formed will contain 30,000 million cubic feet of water, but it is not considered that it will fill more than once in thirty years. Nor is there irrigable land requiring so great a volume of water. Much less would be sufficient, so such a high dam is not needed; but the construction of a waste weir to prevent the submergence of a lower dam would require such heavy excavation through one of the limiting hills that it is cheaper to raise the dam and utilise a natural hollow in the hillside for a waste weir.

IRRIGATION IN EGYPT.

No lecture on irrigation would be complete without describing what has been done in Egypt. You are generally familiar with the shape of that famous little country. Egypt proper extends northwards from a point in the Nile about 780 miles above Cairo—a long valley, never eight miles wide, sometimes not half a mile. East and west of this lies a country broken into hills and valleys, wild crags, level stretches, but everywhere absolutely sterile, dry sand and rock, at such a level that the Nile flood has never reached it to cover its nakedness with fertile deposit. A few miles north of Cairo the river bifurcates, and its two branches flow each for about 130 miles to the sea. As you are probably aware, with rivers in a deltaic state the tendency is for the slope of the country to be away from the river, and not towards it. In the Nile Valley the river banks are higher than the more distant lands. From an early period embankments were formed along each side of the river, high enough not to be topped by the highest flood. At right angles to these river embankments others were constructed, dividing the whole valley into a series of oblongs, surrounded on three sides by embankments, on the fourth by the desert heights. These oblong areas vary from about 50,000 to 3,000 acres. I have said the slope of the valley is away from the river. It is easy, then, when the Nile is low, to cut short deep canals in the river banks, which fill as the river rises and carry the precious mud-charged water into these great flats. There the water remains for a month or more, some three or four feet deep, depositing its mud, and then at the end of the flood it may either be run off direct into the receding river, or cuts may be made in the cross embankments and the water passed off one flat after another, and finally rejoin the river. This takes place in November, when the river is rapidly falling. Whenever the flats are firm enough to allow a man to walk over them with a pair of bullocks, the mud is roughly turned over with a wooden plough, or even the branch of a tree, and wheat or barley is immediately sown. So soaked is the soil after the flood that the seed germinates, sprouts, and ripens in April without a drop of rain or any more irrigation, except what, perhaps, the owner may give from a shallow well dug in the field. In this manner was Egypt irrigated up to about a century ago. The high river banks which the flood could not cover were irrigated directly from the river, the water being raised as I have already described.

THE BARRAGE.

With the last century, however, appeared a very striking figure in Egyptian history, Muhammed Ali Pasha, who came from Turkey a plain captain of infantry, and before many years had made himself master of the country, yielding only a very nominal respect to his suzerain lord, the Sultan, at Constantinople.

Muhammed Ali soon recognised that with this flood system of irrigation only one cereal crop was raised in the year, while with such a climate and such a soil, with a teeming population and with the markets of Europe so near, something far more valuable might be raised. Cotton and sugar-cane would fetch far higher prices; but they could only be grown at a season when the Nile is low, and they must be watered at all seasons. The water-surface at low Nile is about 25 ft. below the flood-surface, or more than 20 ft. below the level of the country. A canal, then, running 12 ft. deep in the flood would have its bed 13 ft. above the low-water surface. Muhammed Ali ordered the canals in Lower Egypt to be deepened; but this was an enormous labour, and as they were badly laid out and graded they became full of mud during the flood and required to be dug out afresh. Muhammed Ali was then advised to raise the water-surface by erecting a dam (or, as the French called it, a barrage) across the apex of the delta, twelve miles north of Cairo, and the result was a very costly and imposing work, which it took long years and untold wealth to construct, and which was no sooner finished than it was condemned as useless.

EGYPTIAN IRRIGATION SINCE THE ENGLISH OCCUPATION.

With the English occupation in 1883 came some English engineers from India, who, supported by the strong arm of Lord Cromer, soon changed the situation. The first object of their attention was the barrage at the head of the delta, which was made thoroughly sound in six years and capable of holding up 15 ft. of water. Three great canals were taken from above it, from which a network of branches are taken, irrigating the province to the left of the western, or Rosetta branch of the river, the two provinces between the branches, and the two to the right of the eastern, or Damietta branch.

In Upper Egypt, with one very important exception (the Ibrahimieh Canal, which is a perennial one), the early flood system of irrigation, yielding one crop a year, prevailed until very recently, but it was immensely improved after the British occupation by the addition of a great number of masonry head sluices, aqueducts, escape weirs, etc., on which some £800,000 was spent. With the completion of these works, and of a complete system of drainage, to be alluded to further on, it may be considered that the irrigation system of Egypt was put on a very satisfactory basis. There was not much more left to do, unless the volume of water at disposal could be increased.

Probably no large river in the world is so regular as the Nile in its periods of low supply and of flood. It rises steadily in June, July, and August. Then it begins to go down, at first rapidly, then slowly, till the following June. It is never a month before its time, never a month behind. It is subject to no exceptional floods from June to June. Where it enters Egypt the difference between maximum and minimum Nile is about 25 ft. If it rises 3½ ft. higher the country is in danger of serious flooding. If its rise is 6 ft. short of the average there existed in former days a great risk that the floods would never cover the great flats of Upper Egypt, and thus the ground would remain as hard as stone, and sowing in November would be impossible. Fortunately the good work of the last twenty years very much diminishes this danger.

THE ASSUAN DAM AND RESERVOIR.

After describing the Assuan Dam (which has been fully dealt with in PAGE'S WEEKLY), the president remarked that its chief use is to enable the perennial irrigation, such as exists in Lower Egypt, to be substituted in Upper Egypt for the basin system of watering the land only through the Nile flood; that is, to enable two crops to be grown instead of one every year, and to enable cotton and sugar-cane to take the place of wheat and barley. But a great deal more had to be done in order to obtain the full beneficial result of the work. About 450,000 acres of basin irrigation are now being adapted for perennial irrigation. Many new canals have had to be dug, others to be deepened. Many new masonry works have had to be built. It is probable the works will be finished in 1908. There will then have been spent on the great dam at Assuan, the minor one at Assiut, and the new canals of distribution in Upper Egypt about six and a half millions sterling.

For this sum the increase of land rental will be about £2,037,000, and its sale value will be increased by about £26,570,000

DRAINAGE.

In the great irrigation systems which I have been describing, for a long time little or no attention was paid to drainage. It was taken for granted that the water would be absorbed, or evaporated, and get away somehow without doing any harm. This may hold good for high-lying lands, but alongside of these are low-lying lands, into which the irrigation water from above will percolate and produce waterlogging and marsh. Along with the irrigation channel should be constructed the drainage channel, and Sir W. Willcocks, than whom there is no better authority on this subject, recommends that the capacity of the drain should be one-third that of the canal. The two should be kept carefully apart—the canal following the ridges, the drain following the hollows of the country, and one in no case obstructing the other. This subject of drainage early occupied the attention of the English engineers in Egypt. In the last twenty years many hundred miles of drains have been excavated, some as large as 50 ft. width of bed and 10 ft. deep.

IRRIGATION IN AMERICA.

If it is to Italy that we should look for highly-finished irrigation works and careful water distribution, and to India and Egypt for widespreading tracts of watered land, it is to America that we naturally look for rapid progress and bold engineering. In the Western States of America there is a rainfall of less than 20 in. per annum, the consequence of which is a very rapid development of irrigation works. In 1889 the irrigation of these Western States amounted to 3,564,416 acres. In 1900 it amounted to 7,539,545 acres. Now it is at least 10,000,000 acres. The land in these States sells from 10s. to £1 per acre it unirrigated. With irrigation the same land fetches £8 10s. per acre. The works are often rude and of a temporary nature, the extensive use of timber striking a foreigner from the Old World. Some of the American canals are on a large scale. The Idaho Company's Canal discharges 2,585 cubic feet, the Turlook Canal in California 1,500 cubic feet, and the North Colorado Canal 2,400 cubic feet per second.

These canals have all been constructed by corporations or societies; in no case by Government. On an average it has cost about 32s. per acre to bring the water on to the land, and a water-rate is charged of from £2 8s. to £4 per acre, the farmer paying in addition a rate of from 2s. to 10s. per acre annually for maintenance. Distributary channels of less than 5 ft. wide cost less than £100, up to 10 ft. wide about £150 per mile.

THE INTRODUCTION OF IRRIGATION INTO A COUNTRY.

It is evident that there are many serious considerations to be taken into account before entering on any large project for irrigation. Statistics must be carefully collected of rainfall, of the sources of water supply available, and of the amount of that rainfall which it is possible to store and utilise. The water should be analysed if there is any danger of its being brackish. Its temperature should be ascertained. It should be considered what will be the effect of pouring water on the soil, for it is not always an unmixed benefit. A dry climate may be changed into a moist, and fever and ague may follow. In India there are large tracts of heavy black soil, which with the ordinary rainfall produce excellent crops nine years out of ten, and where irrigation would rather do harm than good. But in the tenth year the rains fail, and without artificial irrigation the soil will yield nothing. So terrible may be the misery caused by that tenth year of drought that even then it might pay a Government to enter on a scheme of irrigation. But it is evident that it might not pay a joint-stock company.

In all cases it is of the first importance to establish by law the principle that all rivers or streams above a certain size are national property, to be utilised for the good of the nation. Even where there is no immediate intention of constructing irrigation works it is well to establish this principle. Otherwise vested rights may be allowed to spring up, which it may be necessary in after years to buy out at a heavy cost.

The remaining sections of the address dealt with "Modes of Distributing and Assessing Water," and the "Government Control of Water Supply."

SHEFFIELD MEETING OF THE IRON AND STEEL INSTITUTE.

AN unprecentedly large number of members and ladies have intimated their intention of attending the Sheffield meeting of the Iron and Steel Institute.

The following is a revised list of the papers offered for reading :—

1. On the Wear of Steel Rails on Bridges. By Thomas Andrews, F.R.S. (Wortley).
2. On the Metallurgical Department of Sheffield University. By Professor J. O. Arnold (Sheffield).
3. On the Thermal Transformation of Carbon Steels. By Professor J. O. Arnold and A. McWilliam (Sheffield).
4. On the Nature of Troosite. By Dr. Carl Benedicks (Upsala).
5. On the Occurrence of Copper, Cobalt, and Nickel in American Pig Irons. By Professor E. D. Campbell (Ann Arbor, Michigan).
6. On the Transformations of Nickel Steels. By L. Dumas (Paris).
7. On Steel for Motor-Car Construction, and on Vanadium Steels. By L. Guillet (Paris).
8. On the Presence of Greenish-Coloured Markings in the Fractured Surface of Test Pieces. By Captain H. G. Howorth, R.A. (Sheffield).
9. On Over-heated Steel. By Arthur W. Richards (Grangetown) and J. E. Stead, F.R.S. (Member of Council).
10. On Segregation in Steel Ingots. By B. Talbot (Middlesbrough).
11. On a Manipulator for Steel Bars. By Douglas Upton (Jarrow).
12. On the Influence of Carbon on Nickel and Iron. By George B. Waterhouse (New York).

RECEPTION COMMITTEE.

The chairman of the executive committee is Colonel H. Hughes, C.M.G., and Mr. F. Huntsman is hon. treasurer, Mr. J. Rossiter Hoyle, vice-chairman, and Professor J. O. Arnold, Mr. A. McWilliam and Mr. John Wortley, hon. secretaries.

VISITS TO WORKS.

To the list of firms who will be pleased to receive members desiring to see their works, given in the outline programme issued on July 22nd, and reproduced in PAGE'S WEEKLY, the name of Messrs. Davy Brothers, Ltd., engineers, Sheffield, should be added.

OUR WEEKLY BIOGRAPHY.

PROFESSOR L. F. VERNON-HARCOURT, M.Inst.C.E.

PROFESSOR L. F. VERNON-HARCOURT, who recently vacated the Chair of Civil Engineering at the London University College after an honourable tenure of office extending over twenty-three years, is the younger son of the late Admiral F. E. Vernon-Harcourt, having been born in London in 1839.

Educated at Harrow and at Balliol College, Oxford, he obtained a first class in the final mathematical school in 1861, and a first class in natural science in 1862. He took the degree of B.A. in 1861 and M.A. in 1865. On leaving Oxford in 1862, he became a pupil of the late Sir John Hawkshaw, and one of his assistants in 1865, being at the same time elected an Associate of the Institution of Civil Engineers.

Photo, Elliott & Fry.

PROFESSOR L. F. VERNON-HARCOURT, M.INST.C.E.

He was assistant engineer on the Albert Dock works, Hull, in 1865–66; resident engineer of the South-West India Dock works, 1866–70; county surveyor of Westmeath, 1870; resident engineer of Alderney Harbour under the Board of Trade, 1870–72; and of the Rosslare Harbour works and railway to Wexford, 1872–74. From 1875 to 1879 he was engaged for Sir John Hawkshaw in investigations on the Firth of Clyde, and on surveys of the River Witham from Lincoln to Boston, and of the Upper Thames and its tributaries, with a view to the mitigation of floods, and, also, in conjunction with another engineer, in obtaining Acts for a railway from Paddock Wood to Cranbrook.

In 1879, Mr. Vernon-Harcourt commenced practice on his own account in Westminster as a consulting engineer, and has been engaged in reports and various works, chiefly relating to river improvements, harbour and other maritime works, and waterworks; and he has frequently given evidence before Parliamentary Committees on these branches of engineering, notably in the case of the Manchester Ship-Canal Bills since 1883. He has acted as consulting engineer to the Southport Corporation since 1883 with regard to their interests in the

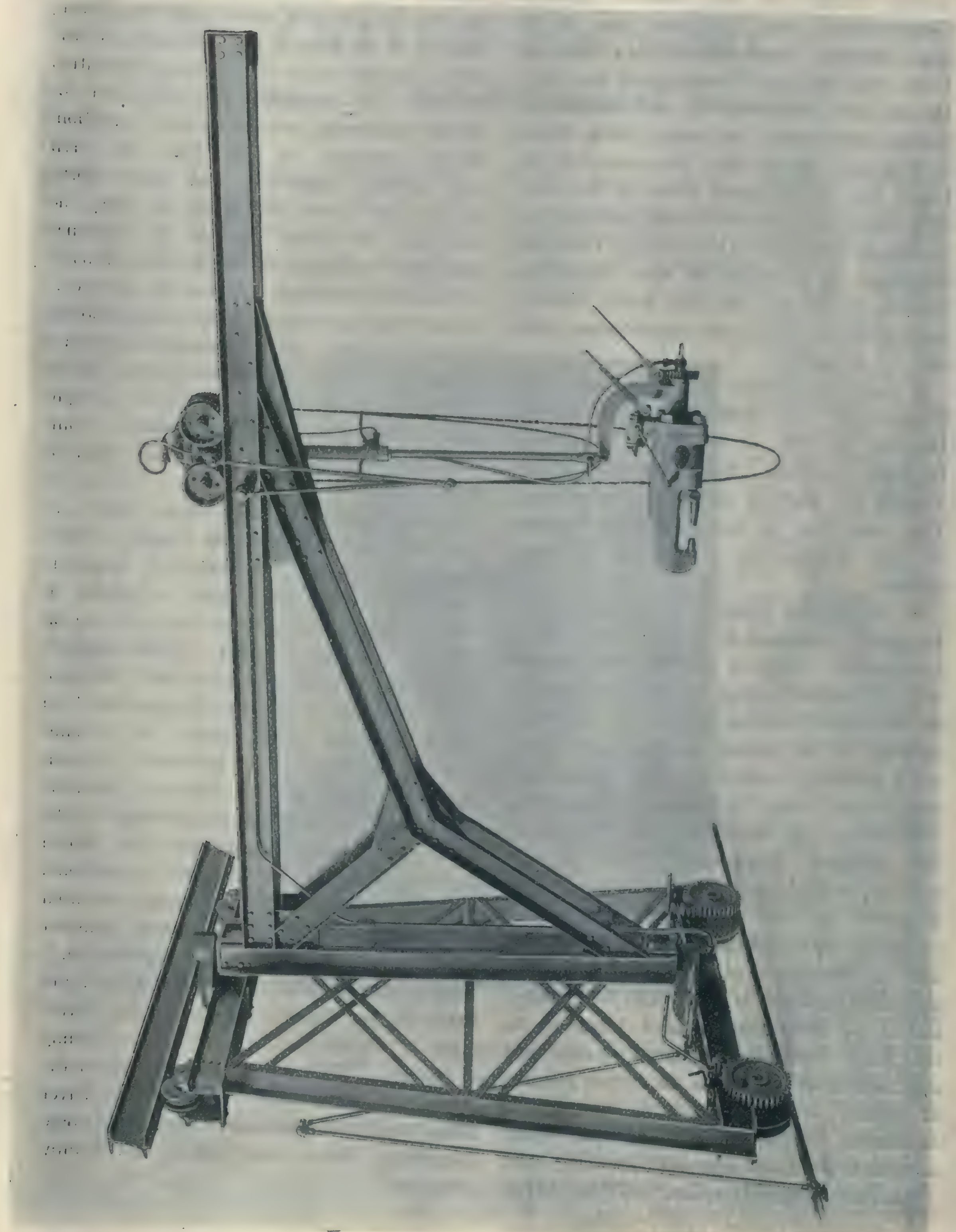
Ribble estuary, to the Newport Harbour Commissioners from the same year, to the Sligo Harbour Commissioners since 1895, and to the Poole Harbour Commissioners since 1903. He has been consulted by, and reported to, several corporations and other public bodies in England; and in 1897 he reported to the Grand Jury of the county Down on the reconstruction of Newcastle Harbour in Dundrum Bay. In 1896,at the request of the Calcutta Port Commissioners, he inspected the River Húgli from Calcutta to the sea, and also above Calcutta, and reported to them on the improvement of the river for navigation.

A course of lectures on "River and Canal Engineering" was delivered by Mr. Vernon-Harcourt in 1880 at the Royal Engineers' Institute, Chatham. Two years later he gave a course on "Harbour and Dock Engineering." The same year he was appointed Professor of Civil Engineering at University College, London.

As the British representative on the Paris Maritime Commission he organised the second International Congress of Maritime Works, held in London in 1893; he was president of the Mechanical Science Section at the Ipswich meeting of the British Association in 1895, and a member of council of the Association from 1895 to 1901; when he became secretary of the "Waterways and Maritime Works" Section of the Glasgow Engineering Congress. He was the delegate of the Institution of Civil Engineers at the International Navigation Congresses of Brussels in 1898, of Paris in 1900, and of Düsseldorf in 1902, and has been appointed a delegate of the British Government and of the Institution of Civil Engineers to the Milan Navigation Congress to be held next September; and he is the British member of council of the Permanent International Association of Navigation Congresses, which meets at Brussels, and organises these Congresses.

Professor Vernon-Harcourt was the British member of the Jury for Civil Engineering at the Paris Exhibition of 1900; as the engineering member of the Liberal Arts Committee of the Royal Commission for the St. Louis Exposition of 1904, he organised the collection of British engineering exhibits for that exhibition. British member of the Jury for civil and military engineering and public works at the St. Louis Exhibition in 1904, he also held the same office on the International Jury appointed by the Austrian Minister of Commerce, which sat in Vienna the same year, for awarding the prizes for designs of canal locks, inclines, and lifts, for surmounting a difference in level of 118 ft. between two reaches of the proposed Danube-Oder Canal. In recognition of these services, he was made a Commander of the Imperial Franz-Josef Order of Austro-Hungary.

Among some of his best known books are the following: "Rivers and Canals," "Harbours and Docks," "Achievements in Engineering," and "Civil Engineering as applied in Construction"; and articles from his pen on "River Engineering" and "Water-Supply" appear in the ninth edition of the "Encyclopædia Britannica," "River Engineering" in the Supplement, and "Canals" in "Chambers's Encyclopædia." Professor Vernon-Harcourt has written various scientific professional papers read at meetings of the Institution of Civil Engineers, the Royal Society, the Society of Arts, and International Navigation Congresses. For papers presented to the Institution of Civil Engineers, amongst which may be mentioned "Alderney Harbour," "Fixed and Movable Weirs," "Harbours and Estuaries on Sandy Coasts," "The River Seine," "Alpine Engineering," "The Training of Rivers," "The Action of Sea-Water on the Deposit of River Silt," "and "The River Húgli," he has been awarded Telford and George Stephenson medals and Telford and Manby premiums.



HYDRAULIC RIVETER CRANE AND LIFT BY MESSRS. RICE AND CO., LTD., LEEDS.

HYDRAULIC RIVETER CRANE AND LIFT WITH SINGLE RAIL.

BY RICE AND CO., LTD., LEEDS.

The accompanying photograph shows a special form of travelling crane, which requires only a single rail, and can consequently work close up to a wall or shop side, thus occupying a very small amount of floor space. It consists of frame work built of channels stayed with cross-braces, and provided with strong double-flanged runners at the bottom and top; the bottom wheels run on a single rail securely attached to the floor, and the top wheels are taken by a rail on the underside of girder or beam as shown. Handles and gearing are fitted so that the whole can be travelled along the shop as required. On this framework suitable brackets are arranged to take the gudgeon pins of the crane, which is built up of steel channels, and has a radius of 20 ft.

Along the jib of the crane a carriage travels by means of hand-chain and gearing, and to this carriage is fitted a hydraulic lift with a stroke of 4 ft., from which the riveter is suspended. The pressure to the riveter is brought down through the centre of the lift, thereby doing away with the necessity for flexible piping or other arrangements for connecting to the water mains.

The pressure water necessary for working the lift and supplying the riveter is brought from the mains, by means of walking pipes, as shown. These are so arranged as to permit the carriage to travel to and fro on the jib with perfect freedom, and also to allow the whole structure to be travelled along the shop for a distance of 35 ft. without disconnecting the pipes.

Although the crane, as shown, is specially arranged for riveter work, it is also adaptable for all classes of lifting where light loads up to 20 cwt. are to be handled. Ball bearings are fitted in the bottom footstep of the crane-post.

Owing to its handiness and the small shop space which it occupies, this type of crane is rapidly growing in favour. Two of these cranes and riveters have been supplied to the Natal Government railways for their new workshops, besides other firms.

THE U.S. BATTLESHIP "KANSAS."

The battleship *Kansas*, launched from the yard of the New York Ship Building Company, Camden, N.J., on Saturday, is a sister ship of the *Vermont* now building at Quincy, Mass. Her general dimensions are: Length on load water line 450 ft., length over all 456 ft. 4 in., extreme beam to moulding 76 ft. 5½ in., to outside of plating 76 ft. 8 in., extreme beam to outside of armour 76 ft. 10 in. Her trial displacement will be 16,000 tons, and when she goes on her speed test she will carry 900 tons of coal, although her bunker capacity is 2,200 tons. Sixty-six tons of feed water will also be carried on her trial trip. The contract provides for a speed of 18 knots for four consecutive hours. Her propelling power will consist of the vertical twin-screw, four cylinder, triple expansion type of engine, of a combined indicated horse-power of 16,500.

The *Kansas* will carry four 12-in., eight 8-in., and twelve 7-in. breech-loading rifles. The secondary battery consists of twenty 3-in. (or 14-pounder) rapid-fire guns, ·50 calibre in length; twelve 3-pounder semi-automatic guns, six 1-pounder automatics, two 1-pounder semi-automatics, two 3-in. field pieces, two machine guns of ·30 calibre, and six automatic guns of ·30 calibre.

STANDARD TELEGRAPH MATERIAL.

ONE of the most elaborate reports yet issued by the Engineering Standards Committee has just come to hand. It is an interim report concerned with British Standard Specifications and Tables for Telegraph Material.

The Sub-Committee on Telegraphs and Telephones was appointed at a meeting of the Electrical Plant Committee (Sir William Preece, K.C.B., chairman) held on December 18th, 1902. As the reference to this Sub-Committee slightly overlapped with that of the Sub-Committee on Cables (Mr. Robert Kay Gray, chairman) in the question of conductors for electrical purposes, it was arranged that the chairman of either sub-committee should *ex officio* be a member of the other.

The standards for copper included in the present report have been agreed to by the two sub-committees, and after having been confirmed by the main committee were issued in the Report No. 7, entitled British Standard Tables of Copper Conductors and Thicknesses of Dielectrics.

The report includes specifications for galvanised iron wire for electrical and mechanical purposes, and also for various types of galvanised iron work in general use for both telegraphic and telephonic purposes in this country and the colonies.

It has not been considered desirable to issue a specification for copper wire. Copper is itself so costly that manufacturers are scarcely likely to stock it in large quantities, more especially on account of the considerable variation in the requirements of different users. It was therefore decided not to go further in the direction of standardisation than the preparation of tables furnishing data based on the standards referred to above. No attempt has been made to standardise submarine or underground cables as it was deemed inadvisable to deal with these questions in the present state of the industry. It has, moreover, not been thought necessary to touch upon the question of standardising telegraphic or telephonic apparatus, or even parts of such apparatus, as the sub-committee felt that no useful purpose could thereby be served. The report was approved by the main committee on July 19th, 1905.

CONTENTS OF REPORT.

The detailed contents of the report may be summarised as follows: Standards for copper conductors, sizes of hard-drawn copper wire sizes of annealed copper wire. Specifications for iron wire for conducting or line wire, iron wire (stranded) for mechanical purposes, iron wire for binding, arm-bolts, nuts and washers, stay swivels, truss and brace rods and truss tie, and brace bolts, stay rods and tighteners, insulator spindles, terminal insulator spindles, single cupholders " J," double cupholders " J," double cupholders, tensile test-pieces.

CONSTITUTION OF COMMITTEE.

The Sub-Committee responsible for the report includes Mr. John Gavey, C.B., chairman; Messrs. H. A. Kirk, representing the India Office; H. Hartnell, representing the General Post Office; Llewellyn Preece, representing the Crown Agents for the Colonies; F. Gill, representing the National Telephone Company; T. Ireland, H. Jackson, and J. Sayers, Nominated by the Railway Telegraph Superintendents' and Electrical Engineers' Conference; A. H. Howard, and F. Jacob. Leslie S. Robertson, M.Inst.C.E., secretary. C. le Maistre, A.M.Inst.E.E., electrical assistant-secretary.

GALVANISED IRON WIRE FOR CONDUCTING OR LINE.*

The specification for the above provides that the wire shall be of mild homogeneous iron, uniformly annealed, soft, pliable, free from scale, inequalities, flaws, splits, and other defects, uniformly cylindrical and of the sizes shown in the annexed table.

The wire shall be drawn in continuous pieces of the weights and diameters given in the annexed table. Each piece must be warranted to contain no weld, joint, or splice whatever, either in the rod before it is drawn, or in the finished wire.

TEST FOR GALVANISING.

The wire must be well galvanised with zinc spelter, and this shall be tested by taking samples from any piece or pieces, and plunging them into a saturated solution of sulphate of copper at 60 deg. F. (15.6 deg. C.) and allowing them to remain in the solution for one minute, when they are to be withdrawn, and wiped clean. The galvanising shall admit of this process being performed four times with each sample, without there being any sign of a reddish deposit of metallic copper on the wire, which would be the case if the coating of zinc were too thin. Samples taken from any piece or pieces of the several sizes shall also bear bending round a bar of the diameter given below, without any sign of the zinc cracking or peeling off.

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* A "mil" is the one thousandth part of an inch.

The 'Standard Ohm" is the unit of resistance adopted by the Board of Trade and legalised by Order in Council of August 23rd, 1894.

Weight per mile in pounds :—

600 450 400 300 200 150 75

Diameter of bar in inches :—

2¼ 1[illegible] 1¾ 1½ 1¼ 1⅛ ¾

The wire must be capable of bearing the number of twists shown in the annexed table, without breaking or showing any sign of splitting or other defect. Further provisions in this section relate to test of wire for defects, tensile test, electrical resistance, diameter rejection, and diameter of eye of coil.

TABLE REFERRED TO IN THE STANDARD SPECIFICATION FOR GALVANISED IRON WIRE FOR CONDUCTING OR LINE.

Weight per Mile.			Diameter.			Tests for Strength and Ductility.						Resistance per Mile of the Standard Size at 60° Fahr.	Constant, being Standard Weight × Resistance.	Weight of each Piece (or Coil).		Weight of each Bundle.	
Standard.	Allowed. Minimum.	Allowed. Maximum.	Standard.	Allowed Minimum.	Allowed Maximum.	Breaking Weight. Minimum.	Number of Twists in 6 inches. Minimum.	For Breaking Weight not less than	Number of Twists in 6 inches. Minimum.	For Breaking Weight not less than	Number of Twists in 6 inches. Minimum.	Maximum.		Minimum.	Maximum.	Minimum.	Maximum.
Lbs.	Lbs.	Lbs.	Mils.	Mils.	Mils.	Lbs.		Lbs.		Lbs.		Standard Ohms.		Lbs.	Lbs.	Lbs.	Lbs.
600	570·0	630·0	209	204	215	1,800	19	1,850	18	1,900	17	8·88	5,328	90	120	90	120
450	427·5	472·5	181	177	186	1,350	23	1,385	22	1,420	21	11·84	5,328	90	120	90	120
400	380·0	420·0	171	167	175	1,200	24	1,230	23	1,260	22	13·32	5,328	90	120	90	120
300	285·0	315·0	148	144	152	900	27	920	26	940	25	17·76	5,328	90	120	90	120
200	190·0	210·0	121	118	124	600	30	620	58	640	26	26·64	5,328	40	65	80	130
150	142·5	157·5	105	102	107	450	32	465	30	480	28	35·52	5,328	40	65	80	130
75	71·25	78·75	74	72	76	225	36	232	34	240	32	71·04	5,328	20	40	80	120

THE INSTITUTION OF MINING AND METALLURGY.

THE following new members have been admitted to the Institution of Mining and Metallurgy : William R. Boggs, North Carolina ; T. Valentine Browne, Day Dawn ; John J. Calderwood, Nicaragua ; F. F. Samuel Evans, Rhodesia ; Samuel George (Transfer), South India ; John W. Gregory, Glasgow ; Bertram Hunt, Central America ; Edward H. V. Melvill, Transvaal ; Paul Ninnis, Spain ; Richard Provis, London ; Arthur E. Westwood (Transfer), Birmingham.

Mr. J. F. Balfour, Assoc.Inst.M.M., has been appointed engineer to the Siamese Trading Corporation, Ltd., for the purpose of investigating the mineral resources of the Kingdom of Siam and the neighbouring States.

"The Consolidated Gold Fields of South Africa (Ltd.)" gold medal and premium of forty guineas have, by the unanimous vote of the Council, been awarded to Mr. Hugh F. Marriott, Assoc.R.S.M., M.Inst.M.M., in recognition of his researches on deep boreholes and deep borehole surveying.

The "William Frecheville" students' prize of ten guineas has been awarded to Mr. E. D. McDermott, Assoc. R.S.M., Stud.Inst.M.M., for his paper on "The Baltic Mill, Lake Superior."

Mr. A. J. G. Swinney, M.Inst.M.M., has left London for the purpose of inspecting some mining properties in Spain.

ALTERNATE CURRENT ELECTROLYSIS.

BY PROFESSOR ERNEST WILSON, M.I.E.E., of King's College, London.

IT is well known that if an alternate current be passed between metal electrodes in an electrolyte, electrolysis may take place. For instance, it has been shown that, in the case of lead plates in dilute H_2SO_4 the SO_4 combines with the lead to form $PbSO_4$, and the plates are eaten away. The present paper gives an account of some experiments made to determine what may be the effect upon certain metals of passing alternating currents between them and certain electrolytes under given conditions. Suppose that an alternating current be passed between electrodes in an electrolyte, and that the curves of potential difference between the electrolyte and one electrode and the curve of current be observed. Let the curve of potential difference be corrected for the fall of potential due to the conductivity of the electrolyte, thereby giving the E.M.F. of electrolysis measurable in volts. Let the current curve be integrated, giving the quantity of electricity measurable in coulombs. We should expect that as the maximum coulombs per half period increased, the E.M.F. of electrolysis would also increase until it had the value given by continuous current, and that with further increase of the maximum coulombs per half period, the E.M.F. of electrolysis would have a constant amplitude. If the process were truly reversible, we should expect to find that the E.M.F. of electrolysis and current would have an effective phase displacement of one quarter period in time.

The plates in a given cell were of like metal, and were separated ⅛ in. (·317 cm.), with their opposing faces parallel. They were held in position by wooden blocks and ebonite distance pieces, bolts, and nuts. The wooden pieces covered the back of each plate, with the view of confining the current to the opposing faces. The area of each of the surfaces exposed in the electrolyte was about 150 sq. cms., but not all of each plate was submerged. For the purpose of obtaining the potential difference between the electrolyte and one of the plates, an exploring electrode, cut from the plate itself, was placed in the electrolyte midway between the plates, and by aid of a revolving contact-maker on the alternator shaft and a quadrant electrometer the curve was obtained. The distance between the exploring electrode and the plate was about 1 mm. Similarly the curve of current was obtained by observing the instantaneous value of the potential difference across a non-inductive resistance placed in the circuit. The curve of current was controlled by inserting a considerable non-inductive resistance in the circuit. The E.M.F. of electrolysis is therefore a dependent variable as regards wave-form. Further research should deal with variation of wave-form. Small test pieces were placed in the solution to see if any action took place without the passage of the electric current. It should be noted that during the experiment the solution in a given cell changes, and therefore an average result has been obtained. No special care was taken to keep the temperature of a given cell constant, and the volume of fluid in each cell was about two litres.

LEAD.

H_2SO_4 dil.—The electrolysis produced by an alternating current when passed between lead electrodes in dilute H_2SO_4 (100 pts. H_2O + 5 pts. H_2SO_4 by vol.) has already been studied. It was shown that for a given R.M.S. current density over the plate, less lead per sq. cm. per hour was dissolved at frequency 92·5 than at frequency 21·5. A R.M.S. density of 0·0236 amperes per sq. cm. would eat away the lead in one year to a depth of 2·6 cms. and 4·8 cms. respectively at the above frequencies. The same current density with direct current would eat away 70 cms. in a year. Since the R.M.S. current density is the same and the wave-form is the same in the two experiments, the maximum coulombs per half period will vary in the inverse ratio of the frequencies, but we do not find that the dissolved lead varies as the maximum coulombs. Referring to the table, experiments 1 and 2 show that at frequency 21·5, 0·00629 gms. per hour per sq. cms. were dissolved. This, multiplied by the ratio of the frequencies, would

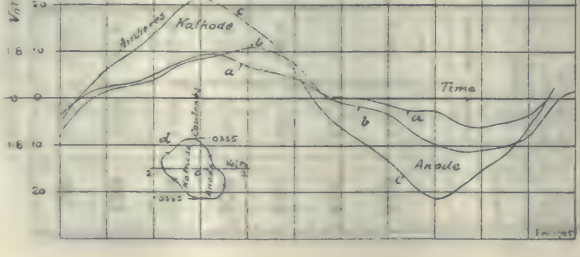


Fig. 1

give 0·00146 gms. per hour per sq. cm. as against 0·00344 actually measured. Experiment 3 was undertaken to discover if at 92 frequency and approximately the same maximum coulombs per half period, the weight of dissolved lead would be the same as in experiment 1. We find that five times as much lead is dissolved at the higher R.M.S. current density. The effect may depend upon the current density, since the maximum coulombs per half period are slightly less in experiment 3 than in experiment 1, whereas the current density is nearly fourfold. Also in experiment 3 the density of the electrolyte fell to 1,036 in eight hours, as against 1,049 in fifteen hours in experiment 1.

In experiment 3, curve *a* fig. 1 is the potential difference between the lead exploring electrode and one plate. This can also be taken to give the E.M.F. of electrolyis, since the conductivity drop is sufficiently small. The curve *b* is the potential difference between the plates, and *c* is the curve of current. It will be observed that the E.M.F. of electrolysis *a* does not change sign at the moment the plate begins to be an anode; the differnce in phase represents the time taken to reverse the E.M.F. existing since the coulombs were last a maximum. The work done during this time is returned to the system. This is not the case when the plate begins to be a cathode, as the reversal of E.M.F. occurs simultaneously with the current, The coulombs have been plotted co-ordinately with the E.M.F. of electrolysis, giving the cyclical curve *d*. As was previously pointed out, more work is done on the system during the time that the plate is a cathode than when it is an anode. The evolved hydrogen combines with the oxygen of the PbO_2, leading to the formation of $PbSO_4$, the maximum coulombs being sufficiently great to produce the peroxide. The plates are not, however, fully polarised in this experiment, much less so in experiment 2, and it may be that the low result in experiment 2 is attributable to the small value of the maximum coulombs. The electrolysis with lead electrodes at low current density is a subject worthy of further research.

It is conceivable that electrolysis by alternating currents may be influenced by diffusion and certain local conditions. When observing the E.M.F. of electrolysis it was noticed that the electrometer deflection became unsteady at certain times of a period, indicating how easily it may be affected. In these experiments the plates were purposely placed near together, and did not give such facilities for diffusion as might otherwise have been obtained.

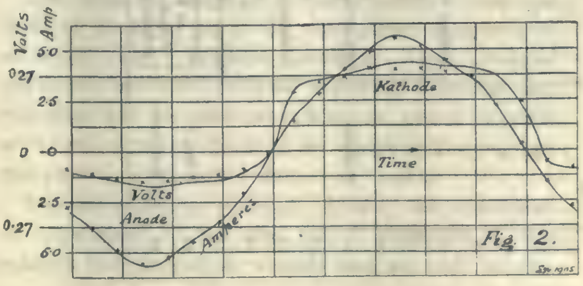


Fig. 2.

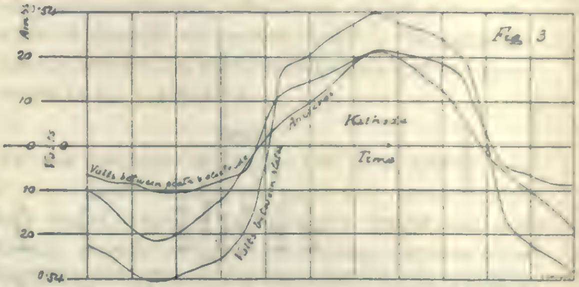


Fig 3

ZINC.

H_2SO_4 dil.—The most marked effects with zinc have been obtained when it has been amalgamated and placed in dilute H_2SO_4 (100 pts. H_2O + 5 pts. H_2SO_4 by vol.). In experiments 4 and 5 the current densities are nearly the same, but the frequencies are different. The dissolved zinc at the higher frequency is greater than we should expect if we simply took the ratio of the maximum coulombs per half period into account. The figures are 0·00147, as against 0·00189 observed, and agree more closely than was the case in experiments 1 and 2. Again comparing the results of experiments 4 and 6, in which the maximum coulombs are the same, we find 0·0053 gms. per sq. cm. per hour dissolved, as against 0·00695 at the higher frequency. It should here be noted that in experiment 6 the plates were not freshly amalgamated, nor was the solution freshly put up. After weighing at the close of experiment 5, the plates were again placed in the same solution and experiment 6 made. In experiment 7 freshly amalgamated plates and fresh solution were used, and the result is quite different from that obtained in experiment 6. To test the importance of the degree of amalgamation and the period of rest between amalgamation and starting the experiment, four new zinc plates were amalgamated to the same degree as nearly as possible and left nearly three days before being used. Experiments 8 and 9 were then made. Comparing experiment 9 with 7, in which the duration of test, frequency, and current density were the same, the agreement is better, since the average gms. per sq. cm. per hour are, respectively, 0·00103 and 0·00166. The results no doubt depend upon the preparation of the plates before the experiment.

Experiment.	Metal.	Solution	Duration of Test in Hours.	Frequency.	Density of Solution.		Temperature of Electrolyte C		R.M.S. Amperes per sq. cm.	Max. Coulombs per half period.	Weight of Plates in grammes.		Difference in weight of two plates after rinsing in water and drying.	Difference in weight after rubbing with wash-leather.	Average grammes per hour per sq. c.m. after rinsing in water & drying	REMARKS
					Before	After.	Before	After.			Before.	After.				
1	Lead	H_2SO_4 dil.	15	21·5	1,050	1,049	17·0	—	0·0236	0·0394	401·019 397·065	385·050 382·834	− 30·2	—	0·00629	
2	„	„	15	92·5	1,050	1,049	17·5	—	0·0236	0·0094	398·977 402·190	390·651 394·016	− 16·5	—	0·00344	
3	„	„	8	92	1,050	1,036	21	32	0·0847	0·0335	389·900 393·105	346·155 348·925	− 87·9	—	0·03230	Fig. 1.
4	Zinc Amalgamated	„	$14\frac{5}{6}$	25·5	1,038	1,068	17·6	19·1	0·0240	0·0345	110·58 116·67	97·98 103·08	− 26·19	—	0·00530	Fig. 2.
5	„	„	18	92	1,038	1,054	21·3	22	0·0253	0·00956	101·724 104·718	96·647 99·073	− 10·72	—	0·00189	Fig. 2.
6	„	„	7	92	1,054	1,066	19·5	27·5	0·0923	0·0346	96·647 99·073	88·939 91·629	− 15·15	—	0·00695	Same solution as in experiment 5.
7	„	„	8	92	1,048	1,055	21	25	0·0889	0·0335	115·155 109·865	112·952 107·776	− 4·29	—	0·00166	Fig. 3.
8	„	„	8	32	1,050	1,058	28·5	23	0·0307	0·0334	110·120 97·935	104·760 94·500	− 8·795	—	0·00337	
9	„	„	8	92	1,050	1,054	28·5	25·5	0·0889	0·0335	105·147 104·457	103·810 103·133	− 2·661	—	0·00103	
10	Zinc	Zinc chloride	$12\frac{1}{12}$	25·5	1,255	1,260	15	20·5	0·0247	0·0345	113·135 114·505	113·300 114·790	+ 0·450	—	+0·000116	Fig. 4
11	„	Zinc sulphate (saturated)	$14\frac{5}{6}$	25·5	—	—	—	—	0·0240	0·0345	109·860 115·237	Not taken	—	—	—	
12	„	Sodium sulphate	18	92	1,100	1,104	20	22·5	0·0241	0·00956	106·703 111·747	106·795 111·841	+ 0·186	— +0·033	+0·000031	Fig. 5.
13	Iron	Ferrous sulphate	18	92	1,114	1,122	21·5	21	0·0273	0·00956	64·188 61·199	63·174 59·786	− 2·427	—	0·000462	Fig. 5.
14	„	„	7	92	1,122	1,125	19·5	29	0·0979	0·0346	63·098 59·786	62·537 59·407	− 0·940	− 1·101	0·000457	Same solution as in experiment 13.
15	„	„	[illegible]	92	1,174	1,186	20·6	25	0·0929	0·0335	60·085 61·330	55·490 56·280	− 9·645	—	0·00389	Tap water used
16	„	„	8	92	1,174	1,186	20·6	25·5	0·0929	0·0335	62·464 59·319	57·211 53·526	− 11·046	—	0·00445	Tap water used.
17	„	„	8	32	1,066	1,102	18·5	21·4	0·0340	0·0334	55·450 56·242	54·460 55·381	− 1·851	− 2·012	0·000787	Distilled water used.
18	„	Sodium chloride	18	92	1,138	1,134	22	21	0·0262	0·00956	67·168 66·242	67·190 66·312	+ 0·092	−0·027 —	+0·000017	Fig. 5.
19	„	„	7	92	1,134	1,128	19·5	23·5	0·0929	0·0345	67·141 66·312	67·225 66·490	+ 0·262	+ 0·173	+0·000121	Same solution as in experiment 18.
20	„	„	8	32	1,086	1,090	19·5	21	0·0312	0·0334	56·977 53·295	57·130 53·397	+ 0·255	—	+0·000100	
21	Copper	Copper sulphate	$12\frac{1}{12}$	25·5	—	1,105	16·25	17·3	0·0265	0·0345	138·145 140·215	138·013 140·162	− 0·185	—	0·000051	Fig. 4.
22	„	„	8	92	1,060	1,092	19	30·5	0·1000	0·0335	134·550 136·875	134·527 136·717	− 0·181	—	0·000079	
23	„	Sodium chloride	18	92	1,138	1,132	21·5	21	0·0241	0·00956	134·235 133·500	134·157 133·413	− 0·165	− 0·276	0·000028	Fig. 5.
24	„	„	8	32	1,066	1,098	18·4	20·3	0·0340	0·0334	134·085 133·365	133·762 133·035	− 0·653	—	0·000278	
25	„	Sodium phosphate	18	92	1,042	1,050	21·2	21·5	0·0241	0·00956	134·674 136·891	134·682 136·892	+ 0·009	— −0·014	+0·0000015	Fig. 5
26	Tin	Proto chloride of Tin	$12\frac{1}{12}$	25·5	1,110	1,120	16	16·8	0·0244	0·0345	123·571 119·491	123·500 119·305	− 0·26	—	0·000066	
27	Aluminium	Potash alum solution (sat.)	2	92	—	—	20·6	98	0·1030	0·0335	—	Not taken	—	—	—	

SUMMARY OF EXPERIMENTS IN ALTERNATE CURRENT ELECTROLYSIS.

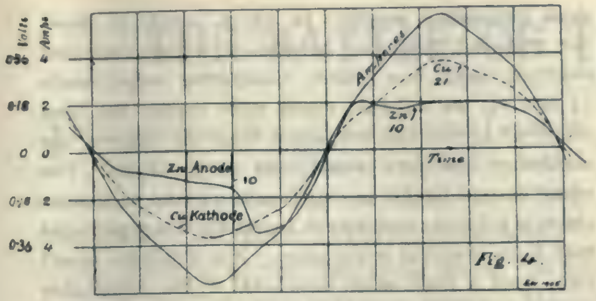


Fig. 4.

The full line curves in fig. 2 were obtained during experiment 4, and the crosses show the corresponding points obtained during experiment 5. The agreement as to wave-form, phase, and amplitude of the E.M.F. of electrolysis at the two frequencies demonstrates that in the case of amalgamated zinc in dilute H_2SO_4 a change from 25 to 92 periods per second does not affect the possibility of the E.M.F. of electrolysis taking the same wave-form, amplitude, and phase-relation. Experiments made with sufficiently increased frequency might throw some light upon the time taken to accomplish dissociation. Fig. 3 shows the curves obtained during experiment 7. The phase relations are practically the same, but the effect of conductivity upon the E.M.F. observed between the exploring zinc electrode and one plate when the current is near a maximum, is slightly observable. Test pieces of amalgamated zinc were in the solutions during the experiments, and were practically unchanged in weight.

Zinc chloride (strong).—The zinc plates in experiment 10 had, when immersed in the solution, a smooth, clean surface, and when taken out after the test they were highly oxidised. In fig. 4, curve 10 was obtained between the zinc exploring electrode and one plate. The potential difference rises to a maximum of 0·32 volts when the plate is an anode, of which 0·01 volt may be due to conductivity. Curve 10 may be taken to be the E.M.F. of electrolysis, and it is nearly in phase with the current. Although the plates have increased in weight during the experiment, it is due to oxidation which leads to their disintegration.

Zinc sulphate (saturated).—Experiment 11 has had little or no effect upon the zinc plates immersed in saturated zinc sulphate solution. The potential difference between the zinc exploring electrode and one plate has the same wave-form as, and is in phase with, the current. There is no visible oxidation, and the process is probably almost reversible.

Sodium sulphate (strong).—Under the conditions of experiment 12 the zinc plates immersed in this solution have gained in weight, and are still heavier (than before experiment) after being rubbed with wash-leather to remove the surface oxide. The potential difference between the exploring electrode and one plate is shown in fig. 5, curve 12.

IRON.

Ferrous sulphate (strong).—The iron plates were cut from good transformer plate and cleaned with emery paper, thereby presenting a bright but not perfectly smooth surface. Alternating currents have a marked effect upon iron in this solution. Experiment 13 was made first, and it was found that the plates lost 0·000462 gms. per sq. cm. per hour. Without changing the solution, which during the experiment had taken up 2·4 gms. of iron, the plates, after being dried and rubbed with wash-leather to remove the surface oxide, were again inserted and experiment 14 made. The frequency was the same in each experiment, but the maximum coulombs were increased from 0·00956 to 0·0346. The result was to dissolve only 0·000457 gms. per sq. cm. per hour, as compared with 0·000462 in experiment 13, the solution again going up in density. Experiments 15 and 16 were then made with fresh solutions, but using tap water instead of distilled. A small quantity of H_2SO_4 was added, to delay oxidation and to correct the calcium salts in the water. The result shows that 0·00389 and 0·00445 gms. per sq. cm. per hour were thrown down, and these are roughly eight-fold the weight thrown down in experiment 14, although the frequency and maximum coulombs are the same. The presence of some free acid in experiments 15 and 16 may be accountable for the high figures obtained. A test sample in the solution of experiment 13 lost 0·4 per cent. of its weight in 58 hours, as against 2·5 per cent. of the submerged portion in seven hours in the experiment. There is considerable electrolysis. Experiment 17 was then made. In it the solution was made with distilled water acidified to the extent of 1 c.cm. of H_2SO_4

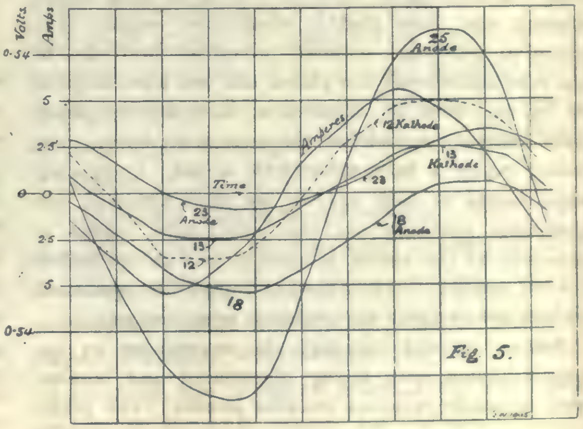


Fig. 5.

in 2,000 c.cms. of water to delay oxidation, and nearly saturated with pure $FeSO_4$. Comparing experiments 13 and 17 for the relation between gms. dissolved and maximum coulombs per half period, we find that 0·000229 gms. per sq. cm. per hour should be dissolved if the relation held, as against 0·000462 observed at the higher frequency. Similar results were obtained in the cases of lead and zinc in dil. H_2SO_4. Lead and iron give, roughly, the same ratio between the observed and calculated weights. It should be remembered that in these experiments not the whole of the plate is submerged in the solution, and there may be some additional effect at the surface of the liquid where it joins the plate.

The curve obtained in experiment 13 between the exploring iron electrode and one plate is numbered 13 in fig. 5. Its flat top indicates that the plates are fully polarised. It is considerably out of phase with the current.

Sodium Chloride (strong).—After washing and drying, the iron plates in experiment 18 have increased in weight, but in the solution a totally submerged test sample through which no current was passed increased weight nearly to the same percentage, so that there is no conclusive evidence of serious electrolysis. Curve 18, fig. 5, was obtained between the iron exploring electrode and one plate. It is very much displaced with regard to the axis of time, possibly due to the fact that the plate is easily attacked when it is an anode, thereby requiring less work during that half period. When passing from the cathode to the anode states a full quarter period in time is required before the work done on the plate becomes positive. Experiments 19 and 20 show that an increase in the weight of the plates takes place, thereby leading to disintegration.

COPPER.

Copper Sulphate (strong).—In experiment 21 the copper plates acquire a fairly easily removable copper deposit, and show slightly diminished weight. The potential difference between a copper electrode, in the solution between the plates, and one plate is given in fig. 4, curve 21. The curve is nearly in phase with the current, and has the same wave-form. One would expect a little electrolytic action. Comparing experiments 21 and 22, we see that although the maximum coulombs are the same, more copper is dissolved at the higher frequency, *i.e.*, at the higher current density. The deposited copper in experiment 22 was not so easily removable as in experiment 21.

Sodium Chloride (strong).—In experiment 23 the copper plates were highly discoloured and covered with an easily removed metallic powder. The plates show diminished weight. In fig. 5, curve 23 shows the potential difference between a copper exploring electrode and one plate. Comparing experiments 23 and 24, we see that much more copper has been dissolved at the low frequency than the ratio of the maximum coulombs would lead us to expect. The effect is considerable in experiment 24, and as sodium chloride is largely met with in the earth, this experiment may have practical importance. The difference would have been a little more noticeable if the detachable deposit had been removed from the surface of the plate before estimating the loss of weight.

Sodium Phosphate Na_2HPO_4 (strong).—In experiment 25 the copper plates were discoloured, but not diminished in weight. In fig. 5, curve 25 gives the potential difference between a copper exploring electrode and one plate. Comparatively this potential difference is large. If correction were made for conductivity, the phase displacements might be sufficient to show almost complete reversibility, and thus account for the small effect observed. If this were so, the effect would be similar to what has already been observed when an alternating current is passed between platinum plates immersed in dilute H_2SO_4. Dissipation of energy still occurs owing to the decomposition of the electrolyte at the plates. Any copper phosphate formed in experiment 25 during one half period would be reduced during the next half period.

TIN.

Protochloride (strong).—In experiment 26 we see that 0·26 gms. of tin have gone into solution, thereby indicating considerable electrolytic action. The curve of potential difference between the exploring tin electrode and one plate is not given in fig. 4. as there was a possibility of the electrode touching one plate during the experiment. It indicated a very small amplitude as compared with the others.

ALUMINIUM.

Potash Alum (saturated).—A good deal of work has been done upon aluminium in connection with alternate currents. It is known that the film formed on the surface offers considerable resistance to the electric current. In experiment 27 two aluminium plates were immersed in a saturated potash alum solution, and, owing to the formation of a surface layer, the internal resistance gave rise to such dissipation of energy that the solution was boiling after the experiment had progressed three quarters of an hour. The plates were very much eaten away in places, but quite bright where they had been protected by the surface layer.

Read before the Faraday Society.

THE BATTLE OF THE SEA OF JAPAN.

THE following views of a prominent Japanese naval officer on the lessons to be learnt from the battle of the Sea of Japan have been translated by The Times Tokio correspondent:—

The teaching of the last great naval battle does not represent any very new lesson. Many points, always recognised as of vital importance remain unaltered. Thus the man behind the gun is as cardinal as ever; so is the necessity of homogeneity of units; so is the value of high speed; so is the inadvisability of having weak vessels like special-service steamers attached to a squadron; so is the disadvantage of going into action with heavily-laden ships and without an adjacent base. All these things must be recognised as not less important than ever. Again, there has been no reversal of the theory that the power of the gun is still inferior to the resistance of armour; in point of fact, the armour of the Russian ships resisted excellently. Further, it has been demonstrated that heavy guns are much more accurate than light, and that battleships are essential factors in a naval fight.

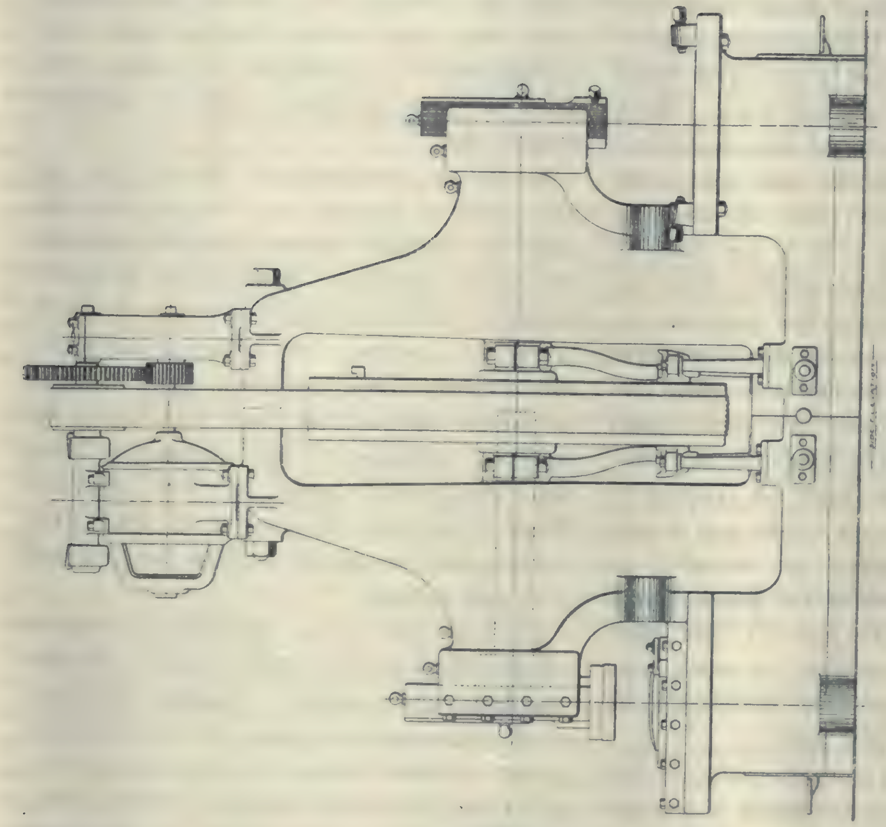
As to the idea that torpedo-craft are not capable of signal service, the lesson of the war is that the utility of these vessels depends mainly on the men handling them. Naval experts have been tolerably unanimous as to all these things, and their verdict now will be that no reasons for a radical change of opinion have been furnished. Nevertheless, there are some noteworthy points. The first is that in the armament of a battleship there should be not only 12-in. guns, but also 10-in. and 8-in., with an auxiliary equipment of 6-in. pieces. Speed, too, must be at least 18 knots, and there should be bunker capacity to suffice for a long voyage.

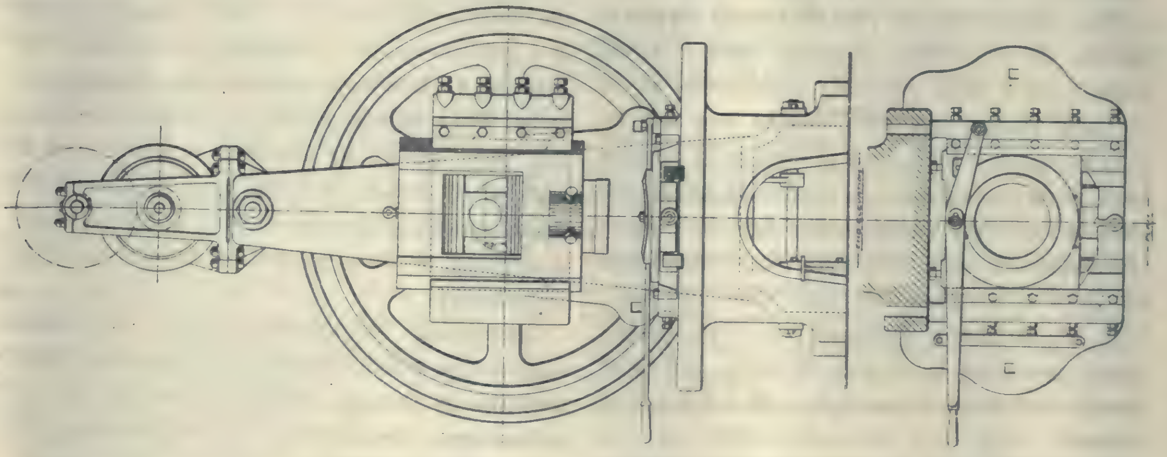
Every battleship should also have armour capable fully of resisting an armament such as she herself carries, and this means that her displacement must be over 16,000 tons. Further, if the probability of improved explosives be taken into account, the armour demanded to resist them may involve building ships with a displacement of something like 20,000 tons. Many of these arguments apply to armoured cruisers also.

As to the armament of cruisers, the line now taken in England, is to mount two 9-in. guns, but probably two 8-in. with strong shields are fully as effective. There can be no doubt, however, of the inferiority of four 6-in. pieces to two 8-in. pieces. The cruiser of the future will probably have four 10-in. guns mounted in turrets fore and aft, with 8-in. pieces for auxiliary armament; the alternative being that the whole should be 8-in. weapons. What is beyond all question is that these cruisers must be capable of developing a speed of at least 23 knots.

To come now to the question of protected cruisers, there has been much learned. Wireless telegraphy was expected to dispense with some of the functions of cruisers, but wireless telegraphy is shown to have its limitations. Protected cruisers remain a necessity. The torpedo-destroyer, with its great speed, suggests itself as a good scout, but its structural weakness and inability to face high seas are plain disqualifications. For scouting as well as commerce-destroying, there should be attached to every fleet a number of cruisers of from 3,000 to 4,000 tons displacement, with a speed of 25 knots at least, something of their protection being sacrificed if necessary.

Concerning torpedo-destroyers, the only direction in which improvement seems specially desirable is that of sea-going capacity. As to submarines, they remain in the experimental stage. Finally, with regard to the general question of the forms of ships, there does not appear to be any reason for change.





NO. 6 STANDARD DUPLEX PRESS WITH MOTOR ATTACHMENT AND BUFFER STRIPPING TOOLS.

BY THE BRETT'S PATENT LIFTER COMPANY, LTD., COVENTRY.

BRETT'S PATENT DUPLEX POWER PRESS ARRANGED FOR DIRECT MOTOR DRIVE.

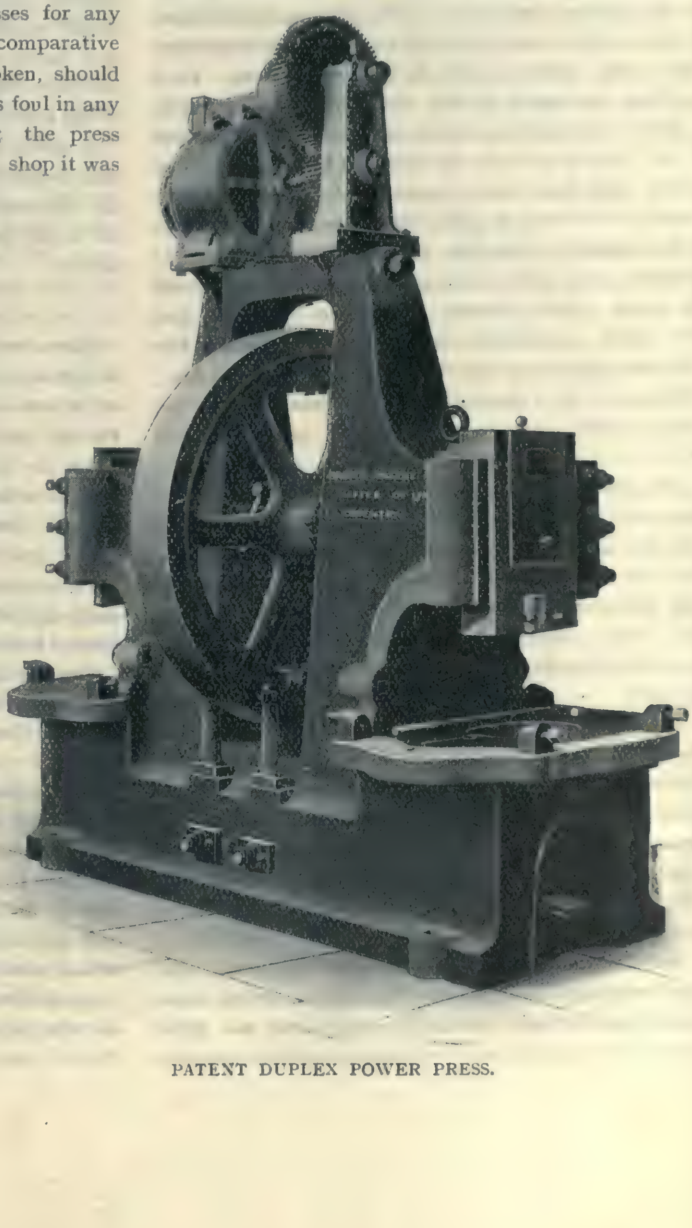
THE rapidly increasing number of firms who are preferring motors applied direct to their machines instead of the usual shafting, etc., has caused the Brett's Patent Lifter Company, Ltd., of Coventry, to give this point their special consideration.

The tool shown in the accompanying illustrations is one of their latest productions, viz., a No. 6 standard Brett's patent power press, duplex pattern, fitted with a semi-enclosed type motor developing 5 b.h.p. at 650 revolutions per minute.

These presses have been specially designed to work in conjunction with drop-forging plant, and possess several features which make them very suitable for this class of work. Users of power presses for any purpose whatever are well aware of the comparative ease with which a press body can be broken, should the work be unusually severe, or if the tools foul in any way. The result is generally the same; the press body breaks right across; in fact, in one shop it was found that out of thirty or forty presses, at least 60 per cent. had been cracked sometime or another, and had been patched up again in various ways. One of the chief claims for this new press is that it is impossible to break the body, and a little explanation of the patent driving motion will, we think, make this clear.

The slide is operated in the usual way by means of an eccentric shaft, which is driven by means of a steel driving arm keyed on at the side of the flywheel. This latter, of course, runs on a feather. Fitted in the massive rim is a steel block, free to slide in and out, and caused to do so by means of a finger-piece on the end, which passes through a guide quadrant at each revolution of the flywheel. This quadrant is so arranged that by depressing a treadle, or moving a hand lever as the case may be, the end is made to swing away from the rim of the flywheel, so that when the block comes round it is pulled out sufficiently to engage on the hardened face of the driving arm, and so revolve the shaft. This arm does all the work, and is so designed that when any unusual strain comes on the slide of the press, instead of the body fracturing, the arm gives way, which of course is not a very serious matter, as it can easily and quickly be replaced for a small amount; whereas a broken body generally means a costly outlay.

Adjustment of slide, special means of setting tools, stopping at the top of stroke, and all practical points have been completely arranged for in designing these machines. The approximate weight of the size illustrated is 10½ tons.



PATENT DUPLEX POWER PRESS.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

(*Continued from page* 422.)

ARGENTINE REPUBLIC.

MR. H. D. HOSKOLD'S report on the Romay iron mines states that they have been visited from time to time by various engineers, whose opinions are not unanimous, but there appears to be evidence that there are extensive and important mineral deposits.

They were discovered in 1873, and in that same year G. Romay obtained the concessions. The National Department of Mines and Geology commissioned one of the assistant engineers of the Mining Department to inspect these mines, and his report, dated September 19th, 1888, shows a very favourable opinion. To a question contained in the instructions, he replied: "With reference to the veins and deposits, my opinion is that these mines offer the base of a large undertaking, which will last some considerable time." Before capital is invested in great expenditure of machinery, it is necessary to determine the extension of the mineral property, and make more genuine experiments in all its parts. The mineral has been assayed and the result published on various occasions. The following analysis is made by Dr. Kyle: Iron, 52·64; oxygen, 19·18; aluminium, 1·80; magnesia, 2·46; titanic oxide, 16·70; sulphur, 0·10; silicate, 6·40; water, 0·72. Total, 100.

The general materials required for the smelting of iron, such as limestone, and other flux, and wood for the charcoal, exist in abundance within the limits of the mine. The quality of the iron produced by charcoal will be of more value than that produced by coke. The actual distance from the railway to the mines is comparatively short; consequently transport, will be cheap.

Mr. Munro, vice-consul at Cordoba, mentions that the present proprietor of the Romay mines is Senor Vicente Juez, of Tucuman. This gentleman would probably be willing to sell, but on what terms is not known. He has recently obtained from the Government of Catamarca the concession to work the mine and is now endeavouring to form a syndicate for that purpose.

Since Senor Juez has taken up this mine, and while digging a well, he has come across several veins of ferruginous ore containing silver, and has great hopes that this silver may be found in sufficient quantity to pay for the extraction of the ore. It is the general opinion that this property is of considerable value, and that it, and the adjacent hills, which are all more or less of the same formation, should be thoroughly surveyed and inspected by a competent mining engineer.

BOLIVIA.

Mr. Beauclerk reports that there are undoubtedly deposits of iron ore existing in Bolivia. They are mostly situated in the mountain districts, where other rich mines exist, *e.g.*, in the region of Potosi, etc.; but they have not hitherto been worked on account of the want of roads and communication with the coast. The initial and serious difficulties of the want of roads and means of transport have first to be overcome, and the Government is not in a condition, financially, to aid in the construction of adequate means of communication

BRAZIL.

There are (says Mr. Consul-General Chapman, Rio de Janeiro) extensive deposits of iron ore in the state of Minas Geraes. They also occur in Sao Paulo, Paraná, and in several other states. What might be called the iron-ore zone in the state of Minas covers an area of considerably more than 3,000 square miles, and the Central Railway traverses the said zone for about 350 kilometres, extending from Barbacena, the nearest point to Rio de Janeiro (which is the nearest shipping port), to beyond Santa Luzia. Barbacena is distant from Rio 379 kilometres.

The principal deposits in Minas are found at Miguel Burnier, Itabira do Campo, Caraca, Gandarella, Antonio Pereira, as also at Congonhas do Campo, Taquaral, Cocaes, Sao Miguel de Piracicaba, Itabira de Matto Dentro, Vicosa, Uba, etc. Many of these are favourably situated for transport by the afore-mentioned Central Railway, especially those of Miguel Burnier, Itabira do Campo and Caraca, and the vastness of the deposits combined with the purity of the ores constitute, probably, if not the most, at least one of the most important iron ore deposits in existence.

In the State of Sao Paulo, at a place caled Itú, iron ore also occurs, and it is also found in the State of Paraná, near the coast, and in the vicinity of Paranaguá and Antonina. These latter ores, however, should be classed as manganiferous iron ores owing to the varying, if low, quantities of manganese contained in same. Definite and reliable information concerning these deposits are not available.

With reference to the deposits of Minas Geraes, and those most favourably situated, the ore would be transported by the Central Railway, which, as is known, belongs to, and is managed by, the Federal Government. The special tariff for the transport of manganese ore in vogue at the actual moment is a zone tariff, and is also applicable to iron ore, and, with exchange as at present at 12 pence, amounts to, say, Reis 6,000 (six milreis), or say, 6s. per ton, irrespective of distance if in the zone. The elevation of the deposits, 4,000 to 4,500 ft. above the sea level, facilitates considerably the cheap transport, the grade being in favour of the load. The State Government imposes a tax on mineral exported, which is generally calculated on a basis of 4 per cent. *ad valorem.*

The labour available is good (principally Italian), but not over abundant, and cost of same at present is reported to range from 2s. 6d. to 4s. per day. The cost of mining, however, would greatly depend on the manner in which the deposits were worked. The outcrops are so extensive and the deposits occur under such favourable conditions for economical mining, that, providing same be initiated on a large scale, and the handling of the ore effected in a similar mechanical and economical way as occurs in the Lake Superior region and elsewhere, the cost could be calculated as inferior to that prevailing in the States, and very much below the mining costs in the Cleveland and other iron-ore regions in the United Kingdom.

Annexed are the analyses of the School of Mines, which are official, and also a report made by Mr. Goodchild, a chemist, on samples of ore from a property at Ubá, in Minas Geraes.

The owners of the properties are legion and, as a rule, poor, but they have a very clear idea of the value of their property. In the opinion of experts, however, it should be possible, dealing through some one who knows them well, to arrange purchases on reasonable terms. Possibly many would prefer to give leases of their property on the basis of a reasonable royalty per ton. Of the many deposits very few have been worked, and these only on a very small scale for local smelting, as at Ipiranga, in the State of Sao Paulo, and at Miguel Burnier, Itabira do Campo, and Sao Miguel de Piracicaba, in the State of Minas.

Limestone of good quality is fairly abundant, but the want of a satisfactory fuel—the production of charcoal being so irregular and expensive—has greatly retarded the iron industry of Brazil, which can only be developed, to commercial advantage, locally, when the smelting of iron ore by electricity reaches industrial perfection.

But once titles are certain (Torrens registration can be obtained but not easily) there are no special obstacles to the continuous and successful mining of iron ore in Brazil, provided same be effected on a large scale and the ore handled economically, as in the United States. Factors to be borne in mind, however, are Inter-State taxation and the exchange, which, when low, favours mining in fixing cost of labour, a high rate acting in the reverse sense. The rate on London has, however, for some time past varied but little from 12 pence to the milreis (Reis 1,000).

A paper presented by Mr. Herbert Kilburn Scott, in May, 1902, to the Iron and Steel Institute, contains much additional information of interest on the iron ores in Brazil. Attention is also called to articles on coal and iron deposits and industries in Brazil, which have appeared in a new publication called the Brazilian Mining Review. Copies can be obtained from Messrs. Ewen, Cattanach and Co., of 18, Great St. Helen's, London, E.C.

The iron ore deposits known in Rio Grande do Sul (says Mr. Acting-Consul Booth) are :—

(*a*) Deposits of magnetic and hematite ore in the Municipality of Sao Jeronymo. Transport by land in carts, about 50 miles to Jacuhy River, from there, by water, another 50 miles to the port of Porto Alegre.

(*b*) Deposits of hematite ore in the Municipality of Cachoeira. Transport by land, in carts, about 40 miles to Jacuhy River, and by water about 200 miles to Porto Alegre.

(*c*) Deposits of rich magnetic ore at Vaccacahy, Municipality of Sao Gabriel. Transport by land about 10 miles, thence by rail to the seaport of Rio Grande, about 200 miles.

The report states that the proprietors are poor and would sell at very low prices.

The ore is known to be rich and of good quality, and the deposits are reported to be extensive, but as heavy transport expenses would make its exportation impossible, no attempt so far, has been made at a closer investigation of these deposits. It might, however, be a lucrative undertaking to convert the ore into iron and steel on the spot, as coal, limestone, manganese and wolfram exist in the immediate vicinity of the deposits.

Mr. Consul Mark (Santos) reports that the most promising fields for iron ore prospecting in his district are in the neighbourhood of Antonina and Sao Francisco, where the shipping facilities are excellent (or could be made so), and the ores are reported to be abundant at numerous localities. The majority of the samples that have thus far appeared from these districts are, however, highly titaniferous, and are suspected to be highly phosphoric as well. Nothing definite is known regarding the manganiferous ores, but there is a reasonable probability that they will prove to be abundant. The only way to obtain reliable information of industrial value regarding the ores of these districts, would be to send an expert to prospect them. The prospecting would be a prolonged and somewhat difficult task as the districts are very mountainous, heavily wooded, and sparsely peopled, and no openings have been made into the ore deposits. Ores of good appearance are known to occur at various points within a short distance of the coast from Iguape to Santa Catherina, and although the greater part of them is not, perhaps, at present available industrially on account of titanium, it is quite possible that available ores will be found in sufficient quantities to be worked. Should this be the case, this region seems to be the most promising one in Brazil for the supply of shipping ores, on account of its nearness to the seaboard, and the excellence of its ports.

CHILE.

Mr. Holberton, Consular Agent, reports on several deposits or iron ore existing in the Consular District of Copiapo, in the form of lodes or veins. The most common ores are "magnetic iron ore," spectacular iron ore "hematite." Many of the lodes, although carrying a high percentage of the iron, are often associated with carbonate of copper, varying from traces up to 4 per cent., and which are simply worked for fluxing purposes for the smelters in the copper industry. As these combined ores would probably not be serviceable for the iron industry, their existence calls for no special remarks beyond that the lodes are abundant, wide, and powerful, and actual sales of ore from them show an average percentage of iron to be 45 per cent. and above. Clear iron ores, in some cases associated with manganese, well suited for the production of pig-iron, are to be found in several localities, but, as no attempts have been made to utilise them in promoting the iron industry, they are, with few exceptions, virgin veins and open to ownership by simple denouncement under the mining laws of Chile.

The best known and most accessible of the lodes of clear iron ore are situated: (*a*) in the Mineral de Patacones; and (*b*) Mineral de Puquios.

At Patacones such lodes as are under denouncement could reasonably be obtained from the proprietors, all of whom are poor miners. There are no obstacles in the way of successful and continuous mining in this district. The mining laws are good, and on the whole they are well administered.

IRON ORES.	LOCALITIES.	COMPOSITION OF THE ORES.										TOTAL.	Corresponding to Metallic Iron.	REMARKS.
		Magnetic Oxide of Iron.	Peroxide of Iron.	Quartz and Silica.	Oxide of Manganese.	Lime.	Magnesia.	Alumina.	Titanic Acid.	Phosphoric Acid.	Loss on roasting.			
Magnetito... ...	Serra do Presidio.	74,022	23,292	1,623	0,000	0,000	1,02		0,000	0,000	0,3000	100,24	69,869	From the table by Dr. Paulo Ferrand, published in the *Revista Industrial*.
Itabirito	Gandarella	68,830	31.720	1,130	0,740	0,140	0,000	1,020	0,000	0,000	1,140	99,99	68,300	Idem.
Itabirito	Gandarella	Nil.	81,900	4,100	9,200	0,000	0,000	0,000	0,000	0,000	1,9000	100,100	59,400	Idem.
Itabirito compacto	Areado ..	Nil.	81,800	15,70	0,170	0,500	0,200	traces	0,000	0,200	0,500	99,070	57,260	Idem.
Oligisto granular...	Caraça ...	0,080	99,801	0,140	0,007	traces	0,000	0,000	0,000	0,005	0,000	99,953	60,860	Idem.
Hematita compacta	Itabira do Campo.	Nil.	94,000	3,400	0,000	0,080	0,000	2,400	0,000	0,000	0,000	99,800	65,800	Analysis made by Dr. A. Biot in the Usina Esperança.
Hematita compacta.	Gandarella	Nil.	99,209	0,240	0,015	traces	0,000	0,000	0,005	0,455	0,000	99,924	[illegible]	From the table by Dr. Paulo Ferrand.
Canga	Ouro Preto	Nil.	79,177	9,250	0,073	traces	0,000	4,000	0,320	6,750	0,000	99,570	55,420	Idem.
Canga	Gandarella	Nil.	91,490	4,780	0,270	0,250	traces	0,740	0,000	2,620	0,000	100,150	64,0400	Idem.
Canga	Esperança..	Nil.	71,600	18,500	0,000	traces	0,0000	4,700	0,000	6,000	0,000	100,800	50,120	Idem.
Magnetito... ...	Ponte Soriano.	Nil.	93,842	3,500	0,000	0,400	0,200		0,000	0,000	0,165	98,107	56,120	Analysis made by Dr. H. Magalhães. (Geological Commission.)
Ferro magnetico...	"Usina Wigg" Miguel Burnier.	Nil.	98,800	1,700	0,000	0,000	0,000	0,000	0,000	0,3300	0,000	99,830	68,200	Analysis by Dr. A. Biot. (Ore analysed in the Usina Esperança.)
Itabirito compacto	Esperança..	75,020	23,980	0,500	0,000	0,000	0,000	0,000	0,000	0,000	0,000	99,500	70,00	Analysed by Dr. A. Biot. (Ore named Pico.)

Iron ore from the town of Sabara, but presented by Sr. R. Joyeux ... ... { Silica ... ... 0·7 per cent.
{ Iron (metallic) 66 per cent.

Analysed in the laboratory of the School of Mines in February, 1900, by Dr. Carlos Tomas.

BRAZILIAN IRON ORES: ANALYSIS OF SCHOOL OF MINES.

THE ACCURACY AND COMPARABILITY OF BRITISH AND FOREIGN STATISTICS OF INTERNATIONAL TRADE.

In Section F at the Meeting of the British Association a report on the above subject was presented by a committee consisting of Dr. E. Cannan (chairman), Mr. W. G. S. Adams (secretary), Mr. A. L. Bowley, Professor S. J. Chapman, and Sir R. Giffen.

In the course of their report the committee state that owing to the differences which exist in the methods of the self-governing colonies in estimating and classifying imports and exports, any attempt to determine the accuracy of such statistics by means of comparison is apt to mislead. At first, it might appear that the exports of, for example, Canada to Australia, should correspond with the imports from Canada recorded in the statistics of the Commonwealth, allowance being made for the difference due to cost of freight, insurance, etc. But the difficulties experienced in recording the origin of goods—for example, goods in the Australian returns may be classified as American when they are Canadian, or as Canadian when they are British—and the uncertainty in the valuation of exports make it clear that the existence of a considerable variation in the respective returns is no real evidence of inaccuracy, but only of incomparability. Moreover, in addition to these causes of incomparability is the fact that a common statistical year has not yet been adopted. In Australia the statistical year, as in Cape Colony, is the calendar year. In Canada the statistical year closes on June 30th; in Trinidad and Jamaica on March 31st. In Bermuda the statistical year is the calendar year. In India thestatistical year closes on March 31st; in Ceylon the calendar year is adopted. Such diversity increases the difficulty of comparison, which is, however. In certain cases obviated, owing to the publication of monthly statements of imports and exports. Also, it is evident that goods exported, at the close of one year from South Africa to Australia will be recorded in the imports of the next year in the statistics of the Australian Commonwealth.

An example of the existing divergencies will be seen in the following figures relating to the trade between Canada and Australia:—

A. Imports into Canada from Australia.

	1902. £	1903. £
Canadian figures (at $5 — £1)	30,611	19,706
Australian figures	33,622	24,837

B. Imports into Australia from Canada.

	1902. £	1903. £
Canadian figures	517,311	585,972
Australian figures	346,560	352,939

SUGGESTIONS AS TO REFORM.

It will be recognised that within the British Empire there is a greater possibility of establishing common statistical methods than is likely to exist among separate foreign countries. In recent years the attainment of this object has been materially forwarded by the establishment of the Australian Federation and the South African Customs Union. The question of common statistical practice throughout the Empire deserves, therefore, to be discussed further, and it is important that it should receive attention at the colonial conferences, and that there should be an interchange of views with the object of reaching a common method of classification, estimation of value, and record of the origin and destination of goods.

It would be of considerable advantage if an annual report on the trade of the Empire were published on a scale sufficiently large to present in considerable detail the trade of the several colonies and dependencies. The statistical abstract for the British Empire issued for the first time in 1905 is a movement in this direction, but much more detailed information is required than can be given in a report of such small compass. Further, it is important that in such report a clear statement should be given as to the differences for which allowance must be made when comparing the statistics of the several colonies. It would also be possible to indicate the gaps in existing information. Such a report would undoubtedly conduce to forwarding the adoption of common statistical methods and practice so far as they can be realised.

It is of great importance that meanwhile local developments towards uniformity such as have taken place in Australia should be carried forward. Thus in South Africa it would be a step in advance if a Year-book showing the trade of the South African Customs Union on a scale similar to the Year-book of the trade of the Australian Commonwealth were published. Again, in the case of the West Indies there is great need for the establishment of closer Customs relations and for the issue of a joint annual report, showing in detail the West Indian trade. At present, in the West Indian returns there is an absence of uniformity in classification and a lack of differentiation. Again, a common system should obtain in India, the Straits Settlements, and the other Asiatic possessions of Great Britain. On the whole, information regarding the trade of the Crown Colonies is very imperfect, and inquiries should be made by the Imperial authorities as to how far it would be possible to establish a system throughout the Crown Colonies and dependencies which will be uniform, and which might also give the detailed information at present lacking.

It is important that a prefatory note should be given in the case of the statistical returns of each colony explaining the system of valuation, registration of origin, and destination, inclusion or exclusion of transhipment and transit trade, bullion, specie, and bunker coal, etc., and affording any other comment which may assist the proper interpretation of the statistics.

Inasmuch as import and export statistics present only one aspect of the trade of a nation, and as the proportion which the import and export trade bears to the internal trade varies considerably in different countries, it is important, both for the purpose of obtaining a more reliable criterion of trade and production of each colony, and for the establishment of satisfactory comparisons to the productive power of the several states comprised in the Empire, that import and export statistics should have a complementary system of statistics showing the internal trade and production of each colony. Several of the British colonies have attempted this in the annual report which they furnish on agricultural and industrial productions. It is clear, however, that great care must be taken in order to avoid the counting of the same wealth several times, owing to the different processes of manufactures which wealth undergoes. For the present the Committee desire only to direct attention to the importance of this matter from an Imperial point of view, in the hope that at some time it may be possible to establish an efficient census of production, agricultural and industrial, within the Empire. A common statistical year should also be established.

BRITISH REPRESENTATION AT THE MILAN EXHIBITION.

WE have heard a good many comments upon the Liége Exhibition tending to show that the machinery exhibits from this country are not insufficiently numerous to be representative of British interests. With satisfaction, therefore, we learn that the forthcoming Milan Exhibition is to receive British official support, and that steps are being thus early taken to give British exhibitors an opportunity of securing suitable representation. At a meeting this week of the Milan Exhibition committee Sir Albert K. Rollit, M.P., chairman of the International Exhibitions Committee of the London Chamber of Commerce, presiding, it was announced that a Government grant of £10,000 will be made in aid of a British section at the exhibition. Provisional arrangements were made for the purpose of communicating with the local authorities of the exhibition at Milan as to space for British exhibitors, and also for ascertaining provisionally what British exhibits may be expected. It was also arranged that a preliminary communication on this subject should be issued from the London Chamber of Commerce on behalf of the committee. It was further arranged that a delegation from the committee, consisting of Lord Brassey, Sir Albert Rollit, M.P., and Mr. Arthur Serena, would proceed to Milan after the approaching meetings of the Associated Chambers of Commerce at Liége, which they are attending officially, to confer with the local exhibition authorities there, and to make provisional arrangements on behalf of the British section, Intending possible exhibitors are requested to communicate with the secretaries of the committee for the Milan Exhibition at the London Chamber of Commerce. The Governments of France, Germany, Austria, the United States, and other countries have already decided to be officially represented at the exhibition, which, as our readers doubtless remember, will be the first international function of the kind to be held in Italy.

SHIPBUILDING NOTES.

THERE was launched on Tuesday afternoon from the Wallsend shipyard of Swan, Hunter and Wigham Richardson, Ltd., a steel-screw steamer, which has been built to the order of Mr. H. W. Dillon, of London. The vessel is of the following leading dimensions: Length overall, 386 feet; beam extreme, 47 ft. 3 in.; depth moulded, 30 ft. 9 in., and she is being designed to carry a deadweight cargo of 6,950 tons on a moderate draught of water. The vessel is being built to take Lloyd's highest class spar-deck grade, with poop, bridge, and forecastle. Accommodation for the officers and engineers is provided in houses on the bridge deck, whilst that for the crew is in the poop. The machinery is being constructed by the Wallsend Slipway and Engineering Company, Ltd., and consists of a set of triple expansion engines, having cylinders 25½, 42 and 70 in. by 48 in. stroke, steam being supplied by two large single-ended boilers working at 180 lb. pressure. On leaving the ways the vessel was named the *Kingsway* by Lady Anne Bowes-Lyon.

On Friday, the 25th ult., Messrs. Osbourne, Graham, and Co., sent to sea for her official trial, the s.s. *Heriot*, which they have specially built for Messrs. George Gibson and Co., of Leith. She is of the raised quarter-deck type, and carries 1,800 tons on a light draft. Accommodation is all amidships, and her equipment and outfit is very complete. Her hatches are specially constructed for long and heavy lifts of cargo, extending almost fore and aft, with winches raised on platforms. Electric light is fitted throughout by the Sunderland Forge and Engineering Company, Ltd., and each hold is lighted with lamps of 2,000 candle-power. The winches and windlass are by Clarke, Chapman, and Co., Ltd., the steam steering gear by Donkin and Co., and the donkey boiler by Cochran and Co., Ltd. The engines are by Messrs. Richardsons, Westgarth, and Co., Ltd., of Sunderland, having cylinders 18½ in., 30 in., 49 in. by 33 in., with one boiler 16 ft. by 10ft. 6in., 180 lb. pressure, and on the trial a mean speed of over 10½ knots was easily attained on the measured mile, after which the *Heriot* went into dock to load for her first voyage.

The steel screw steamer *Aphrodite*, built by Messrs. The Tyne Iron Shipbuilding Company, Ltd., of Willington Quay on Tyne, to the order of Messrs. Harris and Dixon London left the Tyne on Saturday last for her official trip. The vessel, which has been built to class ✠100 A1 at Lloyd's, is of the following dimensions: Length between perpendiculars, 348 ft. 6 in.; breadth, 50 ft.; loaded draft, 21 ft. 3 in. The propelling machinery, which has been constructed at the Northumberland Engine Works, Wallsend, of the North Eastern Marine Engineering Company, Ltd., consists of a set of their latest type of triple-expansion engines, having cylinders 24 in., 39 in., 66 in., by 45 in. stroke., steam being supplied by two large steam boilers working at a pressure of 180 lb. to the square inch. On the trial trip the vessel attained a speed of 11 knots, the machinery working without the slightest hitch throughout, and gave great satisfaction to all concerned. Amongst those present were Mr. H. M. Rogers, representing the owners, Mr. G. F. Mulherion and Mr. Bourne representing the shipbuilders, and Mr. D. Myles and Mr. J. Daglish representing the engine-builders.

On August 22nd the new steel screw steamer *Cameron* recently launched by Irvines Shipbuilding and Dry Docks Company, Ltd., West Hartlepool, and built to the order of Mr. Kenneth McD. Cameron, proceeded to sea for her trial trip. She is of the following dimensions: 336 ft. by 47 ft. by 24 ft. 10 in. The vessel is built to Lloyd's highest class under special survey, and is of the single deck type, having poop, bridge, and top gallant forecastle. Engines of the triple-expansion type have been supplied and fitted by Messrs. Richardsons, Westgarth, and Co., Ltd., Hartlepool, having cylinders 24 in., 38 in., 64 in. by 42 in., two large single-ended boilers giving 160 lb. pressure. The vessel has been supervised during construction on behalf of the owners by Mr. R. Adams. After adjusting the compasses a series of runs were made when a mean speed of eleven knots was obtained, the engines working smoothly and well. The vessel subsequently proceeded to Archangel.

The launch of the latest addition to the trans-atlantic fleet of the Hamburg-American Line took place from the Vulcan yards at Stettin on Tuesday, the ship receiving the name of *Kaserin Auguste Victoria* at the hands of the German Empress. The new vessel is a sister ship of the American, which is being built in England for the same owners. The capacity of these ships is 25,000 tons each; they are designed for a speed of 17 knots.

OPENINGS FOR TRADE ABROAD.

Natal.

The Durban Town Council have been empowered to increase the water supply to the town, and to construct the necessary reservoirs, tunnels, conduits, water mains, etc

France.

The Waterworks Department of Paris require tenders by the 12th prox. for the supply and erection of motors, pumps, and generators for the proposed waterworks at Chantilly. For particulars apply to above Municipality.

Mexico.

An opening occurs for hydro-electric plant, Senor Antonio Felguerez having made application for an appropriation of 100 litres of water per second from the San Andrés, in the States of Zacatecas and Durango, for the production of motive power.

Egypt.

The Egyptian Railway Administration invites tenders for the supply of 210,000 metric tons of Welsh coal during 1906, the last day for sending in quotations being October 1st. A copy of the conditions governing the tenders may be obtained from Lieut.-Colonel Western, R.E., Queen Anne's Chambers, Westminster S.W.

Brussels.

Railway tenders, which will be opened on September 13th, are invited for construction of a railway between Meirelbeke and Herzele, at the estimated cost of about £10,713. A deposit of £1,040 is required to qualify any tender. Tenders, in sealed envelopes, addressed to M. le Directeur-Général, Société Nationale de Chemins de Fer Vicinaux, 14, rue de la Science, Brussels, should be delivered by the 12th inst.

India.

Formal sanction has been accorded to the work of renewing the girder bridges on the Howrah, Chord Line, Dinapur and Allahabad districts, and also of the Tonse Bridge and of fourteen spans on the Jubbulpore Line at an aggregated cost of about 7,34,000 rupees, to be appropriated from the Budget provision of 1905-6.

Tenders are required for the construction of a new pier for tank oil steamers at Sewree, near Bombay, for the Bombay Port Trustees. The pier to consist of a Moorum bank (about 8,000 ft. long), a screw pile pier (about 3,000 ft. long), a screw pile pierhead, dolphin, and landing pier or stage. Copies of the specification and drawings of the work can be obtained from Messrs Sir J. Wolfe Barry and A. J. Barry, 7, The Sanctuary, Westminster, S.W.

Argentine Republic.

In a recent dispatch, H.M. Consul at Buenos Ayres reports as follows regarding various openings for trade in the Argentine Republic: There seems to be no limit to electrical work. In a very short time there will not be a horse-drawn tramcar in Buenos Ayres. A commencement has been made in the construction of lines to the more distant suburbs. British manufacturers appear to be competing for this business and getting a share of it. Electric lighting is being installed even in small towns and villages.

Santo Domingo.

The United States Consul reports that with a view to encouraging agriculture, commerce, and transportation, Decrees have been enacted and proclaimed in the Republic of Santo Domingo, providing for the setting apart from January 1st, 1906, of 30 per cent. of the revenue received from exportations, to be devoted to the construction of railways in the State. The Executive power, in arranging contracts and giving concessions to construct railroads will endeavour, under equal conditions to grant them on an equal basis, giving preference to the railroad from Moca to Monte Christi, connecting with the Dominican Central Railroad; from Barahona to Laguna del Fondo; from the Romano or Macoris del Este to the Seybo; and from Azua to Bánica.

Portugal—Angola.

The British Acting Consul at Loanda in his recent report remarks that the returns of the Royal Trans-African Railway show an improvement on the previous year. The continuation of this line from Ambaca to Malange is being carried on by the Government. The material used mostly comes from Belgium in German steamers. The construction of the Benguella Railway has been started. The idea of this railway is to connect Katanga and the Tanganyika Company's concession with the West Coast. It is expected that it will be carried through the Bihe district. Referring to the Royal Decree, authorising the expenditure of over £300,000 on the construction of a railway of 60-centimetre gauge from Mossamedes to the table land of Chella, the Consul says that this railway will be constructed by the Government.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Neath.—Reconstruction of a bridge over the River Neath and Tennant's Canal, near Neath station, Great Western Railway. G. K. Mills, secretary, Paddington Station Sept. 5

London, W.—Supply of about 230 tons of steel bridge girders and other steel and iron work of British manufacture, for the Great Western Railway Company. Engineer, Paddington Station ... ... Sept. 5

Halsall (Lancs.).—Building two small bridges in brickwork and steel girders over two brooks in the township of Halsall, for the West Lancashire Rural District Council. Mr. C. Law-Green, A.M.Inst.C.E., Wigan Road, Ormskirk ... Sept. 6

Upton Scudamore. — Carrying out a waterworks scheme for the village of Upton Scudamore, for the Warminster Rural District Council. Mr. A. F. Long, 53, Market Place, Warminster .. ... Sept 9

Hull.—Construction and erection of the new steel swing-bridge over the River Hull at Sculcoates, on their Victoria Dock branch, and weighing about 450 tons, for the North-Eastern Railway Company. The contract will include the removal of the existing swingbridge, the raising of the public road, and the building of river walls, timber jetty, etc. Mr. W. J. Cudworth, company's engineer, York ... .. Sept. 11

Bristol.—Construction, delivery, erecting in place, testing, and maintenance for 12 months of pumping machinery for the dry dock now in course of construction at Avonmouth, in the port of Bristol, for the Docks Committee. The contract includes steam engines, centrifugal pumps, steam-boilers, and all auxiliary machinery and piping for the complete installation. Mr. W. W. Squire, Cumberland Road, Bristol. Sept. 11

London.—Supply and delivery of 150 wagons and 10 brake vans, for the Directors of H.H. the Nizam's Guaranteed State Railways Company, as per specification to be obtained at the Company's offices for 10s., which amount will not be returned. Mr. H. Rendel, Winchester House, 50, Old Broad Street ... ... Sept 11

Sculcoates.—Construction and erection of the new steel swing-bridge over the River Hull at Sculcoates, on their Victoria Dock branch, and weighing about 450 tons, for the North-Eastern Railway Company, including removal of existing swingbridge, the raising of the public road, and the building of river walls, timber jetty, etc. Mr. W. J. Cudworth, the company's engineer, York ... ... Sept. 11

Last Day.

Bishop's Stortford. — Supplying and fixing gas pumping engine, suction gas plant, and sewage pumps at sewage pumping station. Mr. Thos. Swatheridge, clerk, Council offices, 7, North Street, Bishop's Stortford ... ... Sept. 12

Knottingley.—Supply of a cast-iron settling tank (capacity 80,000 gallons), steel girders, brick piers, etc. Messrs. Garside and Pennington, Pontefract ... ... Sept. 12

Ipswich.—Supply and erection of a dynamo and motor, a battery booster, and alterations and additions to the main switchboard at the workhouse. Mr. Richard J. Kent, clerk, 19, Tower Street, Ipswich ... ... Sept. 14

Portsmouth. — Provision of machinery, forges, engines, lathes, etc., required in connection with the fitting up of the new manual instruction centres for the Portsmouth Education Committee. Mr. Alfred H. Bone, Cambridge Junction, Portsmouth ... ... Sept. 18

Immingham. — Construction of a new dock, having a water area of about 42 acres, together with a lock and entrance from the river Humber, entrance jetties, river embankments, drain diversion, and other contingent works; also a double line of railway, about 4½ miles in length, and other railways and sidings surrounding the dock, having an aggregate length of about 4 miles. Sir John Wolfe Barry and Partners, 21, Delahay Street, Westminster ... ... Sept. 20

COMING CONTRACTS.

Uxbridge.—The Rural District Council have decided to apply for sanction to a loan of £5,000 for sewerage works at Hillingdon.

Limerick.—The Birr Urban District Council have approved of a new sewerage system at a cost of nearly £8,000.

Leith.—The Leith Dock Commissioners have under consideration a scheme for the laying down of a new yard between the west end of the old docks and the fishing port of Newhaven.

Malvern.—The District Council are raising a loan of £20,000 in connection with the new water scheme.

Great Grimsby.—The electric lighting committee have decided to expend £18,000 on additional engines, dynamos and mains.

Buxton.—The Urban Council have adopted the report of their electrical engineer, Mr. Leeming, by which £4,000 will be spent on extensions to the department.

Petersfield.—The Rural District Council have instructed Mr. Harry W. Taylor, A.M.Inst.C.E., of Birmingham and Newcastle-on-Tyne to prepare a scheme of water supply for the parish of Liss.

Macclesfield.—The Green Street site has been adopted for the new electricity works, and the engineer (Mr. Woodward) is about to prepare plans and specifications for machinery required, and to advertise for tenders.

Aberdeen.—The Corporation have decided that Union Bridge shall be widened at a cost of about £17,000.

CONTRACTS CLOSED.

Leeds.—Messrs. Samuel Denison and Son, Ltd., have the following orders on hand for the Blake-Denison Conveyor Weighing Machine: 3 for Norway, 3 for South Africa, 1 for the U.S.A., and 2 for the Great Western Railway Company (England). This machine is winning high approval in many parts of the world, including Holland, North Africa, and Western Australia.

Loughborough.—The Bombay Electric Supply and Tramways Company, Ltd., have placed an order with the Brush Electrical Engineering Company, Ltd., for sample single deck and double deck tramcars, complete with trucks and motor equipments.

Aberdeen.—Hadfield's Steel Foundry Company have secured an order for the supply, delivery, and fitting up complete of manganese steel points and crossings and special track work required for dock railway lay-outs, for the Aberdeen Harbour Commissioners.

Barnton.—The Northwich Rural District Council have placed an order with Mr. S. Hutton, Stamford Road, Bowdon, for the construction of septic tanks, bacterial filters, storm-water filter, and auxiliary works, at Barnton, together with about 1,800 lineal yards of 12-in. and 9-in. stoneware sewers, with manholes, pump well, syphon chambers, etc.

Motherwell.—Indian State Railways Company have placed a repeat order with the Stirling Boiler Company, Ltd., for one marine type boiler to evaporate 10,000 lb. of water per hour, with chain grate stokers, motor, fan, chimney, pumps, piping, etc. The same firm have an order from the Cawnpore Tramways Company for three marine type boilers, each to evaporate 6,500 lb. of water per hour, complete with superheater and chain grate stoker.

Aberdeen.—The County Council have accepted the contract of Mr. P. Tawse, for the construction of a cement concrete reservoir (300,000 gallons) in connection with the high-service supply to the Cults special water district.

Glasgow.—Messrs. D. Y. Stewart and Co., have secured a contract amounting to £3,610 from the Metropolitan Water Board for the supply of about 525 tons of cast-iron pipes and castings.

Leigh.—The Borough of Leigh Electricity Works have ordered from the Stirling Boiler Company one boiler to evaporate 13,600 lb. of water per hour fitted with superheater and Hodgkinson stokers

Tynemouth.—The Council have accepted the tender of J. W. Braithwaite and Co. for extensions of the electricity works at £1,967 15s.

Warrington.—Masons Gas Power Company, Ltd., Manchester have received an order from N. Greening and Sons, Ltd., for the erection of a gas producer plant, wire annealing furnace, etc, at their new works at Warrington.

APPOINTMENTS VACANT.

Derby.—County surveyor for the Derbyshire County Council. £500. Mr. N. J. Hughes-Hallett, clerk... ... ... Sept. 6

Bristol.—Assistant lecturer and demonstrator in engineering is required at the Merchant Venturers' Technical College, Bristol. £170. Registrar ... ... Sept. 18

Handsworth, Staffs.—Station Superintendent and an assistant engineer for the Council's electricity works. £120 and £100 per annum respectively ... ... Sept. 30

Battersea.—Lecturer in electrical engineering for the Battersea Polytechnic. Lectures and practical classes three evenings a week for the session September to May. £150. Mr. Joseph Harwood. ... ... Sept. 6

Todmorden.—Gas engineer. Todmorden Corporation. £200. Town clerk ... Sept. 16

King's Lynn.—Borough surveyor and waterworks engineer. King's Lynn Corporatien. £250. Mr. J. W. Woolstencroft, town clerk ... ... Sept. 18

Poplar.—Junior demonstrator in physics and electrical engineering to the London County Council School of Marine Engineering, Poplar. Salary at the rate of 10s. 6d. an evening ... ... Sept. 11

APPOINTMENTS FILLED.

Dover.—Mr. H. E. Osborne, electrical engineer-in-charge to the Watford Urban District Council, has been appointed to a similar position by the Dover Corporation, and his place has been filled by Mr. C. S. Taylor, of Erith.

Cheltenham.—Mr. W. J. Bache, city electrical engineer of Gloucester, has been appointed borough electrical engineer of Cheltenham.

Delhi.—Mr. T. Salkield, surveyor to the Leatherhead Urban District Council, has been appointed chief engineer to the municipality of Delhi, India.

Salford.—Mr. Cecil H. Lander, B.Sc., of Stockport, has been appointed assistant lecturer in mechanical engineering at Salford Royal Technical Institute.

Ashton.—The District Council have appointed Mr. Harry A. Harding, of Leatherhead, assistant electrical engineer at £130 per annum.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—
Consols : Sept. 1st. General Settlements : September 14th, 28th, October 13th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,870	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	5	2⅜— 2½
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½-- 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 5/16—3 7/16
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5⅜— 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102½—104½
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord. ..	1	8½— 8¾
100,000	1	7½d.	Do. „ 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾— 5¼
250,000	1	6⅜d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1 3/16— 1 5/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛— 4⅜
83,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104½—106½
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾— 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	5/16—7/16
300,000	1	6⅜d.	Do. 5½% Cum Pref.	1	9/16—11/16
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	93 —96
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	31/32— 1 1/32
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	17/32—19/32
1,160,000	1	10½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16— 1 5/16
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅝ — 1¾
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11⅛—11⅜
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord. ..	5	8⅞— 9⅛
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5½— 5¾
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	15/16— 1
70,000	5	2/6	Do. 5% Cum. Pref	5	5¼— 5½
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 -102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	31½— 32½*
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15¾—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	9/16—⅝
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	90 —94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	3¼— 3¾
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	⅝—¾
300,000	1	7½d-	Do. 6% Cum. Pref. ..	1	13/16 -15/16
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½— 9½
69,754	13	10/-	Do. do. do.	10	6¼—6¾
20,250	10	8/-	Elliott's Metal, Ltd.	8	5¼— 5¾
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾— 9¼
186,748	Stk	4%	Do. Deb. 4%	100	90 — 94
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	11 —11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd, Ord. Nos. 1/9000..	10⅛	12¼—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9⅞—10⅛
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	3¾—4¼
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5½— 6
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6½— 7½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	88½—89½
16,800	10	10/-	Greenwood & Batley, Ltd., Ord. ..	10	7 — 7½
9,600	10	7%	Do. 7% Cum. Pref.	10	10 — 10½
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅜— 2½
344,000	5	2/6	Do. 5% Cum. Pref.	5	6½— 6¾
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
18,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'ory Co., Ld., Ord.	1	3½— 3⅝
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½— 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	11/16 — 13/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97— 99
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5 — 5⅛
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16—13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅞—5⅛
£100 000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord. ..	1	1 7/16 — 1 9/16
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¾—13¼
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95 —98
37,500	10	20	Kynoch, Ltd.	10	17 —17½
49,537	10	5%	Do. Cum. Pref. 5%	10	10½—10¾
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	⅜— ½
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref. ..	3	4 — 5
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16— 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref.	10	11½—12
210,000	1	8⅜d.	Measures Bros., Ltd., Ord.	1	½— ¾
75,000	1	6⅜d.	Do. 5½% Cum. Pref.	1	¾ — ⅞
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	4½— 5
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	80 — 82
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88 — 91
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅝— 3⅞
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	6¼— 6¾
70,000	10	10/-	Pease & Partners, Ltd., Ord. ..	10	9½—10
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock ..	100	100—103
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm.P.	5	4⅞— 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4¼— 4¾
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	¼ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅝— 1⅞
73,062	5	2/-	Do. New	5	1½— 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	99—101
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	13/16— ⅞
£350,000	1	7⅕	Do. 6% Cum. Pref.	1	15/16— 1 1/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	10 —10½
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	⅝ — ¾
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	93 — 95
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	93 — 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	95 — 99
250.000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	¾ — ⅞
300,000	1	1/2⅖	Do. 6% Cum. Pref...	1	13/16— 15/16
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	92 — 95
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	6¼—6¾
£125,240	Stk.	5%	Do. 5% Trust Mort. Deb. ..	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	1⅞— 2⅛
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3⅞— 4⅛
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	80— 85
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17¾—18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼— 14¾
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾ — ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	15/16— 1 1/16
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	⅝ — ¾
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	80 — 83
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	⅝ — ⅞
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼— 9¾
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	37⅞— 38⅛
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	107¾-108¼*
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	99 —101
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 7/16—2 9/16
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 3/16— 1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	120 —123
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16— 15/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	86 — 88
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½— 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2½— 3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73 — 78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74 —76

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9⅗	London Elec. Supply Corp., Ld., Ord.	3	2 — 2½
60,000	5	3/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 -102
100,000	10	5/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	10¼ —10¾*
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5½— 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	98 —100
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½— 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref...	5	8½— 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 2⅞
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 — 15/16
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 5/16 — 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	106 —109
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅝ — 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	105—107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅝

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
£25,000	10	—	Amazon Telegraph Co., Ld... ..	10	3 — 3½
£763,580	Stk	14/-	Anglo-American Tel. Co., Ltd., Ord.	100	59 — 61
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	105¼ —106½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15¼ — 15½
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅛— 7⅜
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	9¼— 9¾
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	11½—11¾
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	99½—101½
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101½103½%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾—14¼
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105½—107½
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	143 --146
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90½—92½
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	108 —110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 —36
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99—101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	53 — 54
72,680	1	7⅕d.	Monte Video Telephone Co., Ltd., O.	1	¾— ⅞
£1,983,338	Stk	6%	National Telephone Co., Ltd., Pref.	100	109½—110½
£1,966,667	Stk	5%	Do. Deferred	100	107½—109½
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅝ — 5⅞
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99½—101½
£689,593	Stk	4%	Do. 4% do. do. ..	100	104 —106
179,313	1	8⅖d.	Oriental Telephone & Elec. Co., Ltd.	1	1 3/16—1 5/16
50,000	1	7⅕d.	Do. 6% Cum. Pref.	1	1 3/16—1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½— 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛— 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	109—111
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	9½ —10
£30,008	2½	—	West Coast of America, Ltd. ..	2½	9/16 — 11/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100—102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	11/16— 13/16
34,568	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6¼— 6¾
£80,000	100	5%	Do. 5% Deb.	100	101 —104
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾—14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	102½—104½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9 — 9½
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	101—103
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	95 — 97
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11¾— 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1¼ — 1½
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	129 —132
£1,160,000	Stk	19%	Do. do. Deferred ..	100	227 —230
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	35 — 36
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¾— 9¼
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1⅛ —1¼
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	126 —131
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	½ — ⅝
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅜— ½
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ —1¼
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1 1/16 —1 3/16

RAILWAY CARRIAGE & WAGON COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22 — 23*
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8⅞— 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾—14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9¾— 10
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2½— 2¾
4,150	10	5%	Do. do.	10	10⅜—10⅝
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	42/6—43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/9--24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/6--29/-
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18 —19*

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount ubscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝—⅞*
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16—9/16
120,000	1	1/2⅖	Bell's Asbestos Co., Ltd.	1	1¼—1⅜
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord.	5	5½—6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½—6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102—105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅜—2⅝
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	85—89
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½—¾
150,000	2	2/4⅗	Do. 6% Pref.	2	1¼—1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92—95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	78—81
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10—11
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5½—5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107—109
85,000	3	1/6	Crompton & Co., Ltd...	3	1¼-1¾
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94—99%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾—8½
61,000	5	3/-	Do. 6% Cum. Pref.	5	6—6½
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105—107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛—1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Free. Deb. Stk.	100	106—109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛—1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2—2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83—88
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89—94
112,100	2	1/7⅕	Electric Construction Co., Ltd. ..	2	⅝—⅞
31,390	2	2/9⅗	Do. 7% Cumulative Pref. ..	2	1¾—2¼
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92—95
10,248	10	7/6	Evered and Co., Ltd...	10	10—12
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90—95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½—10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅝—5⅞
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½—16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100—103
7,500	10	—	Parker, Thos., Ltd.	10	6½—7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	32½—34½
£150,000	100	4%	Do. 4% Deb. Bonds	100	102—104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	9—9¼
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅞—6⅛
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141—144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13¾—14¼
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½—10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	98—101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97—102
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	13/16—15/16
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16—1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1—1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	4—4½
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95—98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	109—112
		5%	Pref. Ord. Stock	100	102—105
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	8⅛—8⅝
156,437	10	6/-	Do. 6% Cum. Pref.	10	10⅝—11⅛*
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122—124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97—99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3—3¼
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½—5¾
27,000	5	3/-	Do. "B" do.	5	4¾—5¼

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96—98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101—105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	9¾—10¼
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107—109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅛—1⅜
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞—5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99—102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103—105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½—14½
59,987	10	6/-	Do. 6% Pref...	10	15—16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½—3
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	83—88
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9¾—10¼
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99—102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	102—104
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼—5/16
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1—1 1/16*
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105—107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½—1½
110,923	8	3/2⅗	North Metropolitan Tramways Co..	8	4½—4¾
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93—98
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103—106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾—9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9—9½*
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101—104

IV.—ELECTRIC LIGHTING AND POWER.

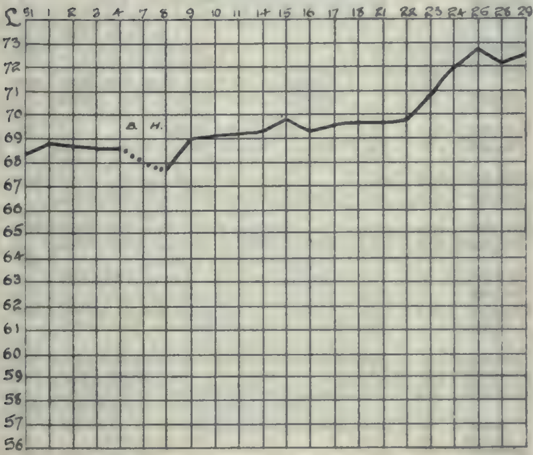
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾—12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾—10¼*
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11—12*
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105—107
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼—5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	104—107
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10—10½*
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9⅝—10⅛*
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9—9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103—106
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	6¾—7¼*
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5¼—5¾*
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103—105
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6⅛—6⅝
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108—110
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10½—11
40,000	10	6/-	Do. 6% Cum. Pref.	10	13—14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123—127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103—105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	8½—9*
30,000	10	6/-	Do. 6% Cum. Pref.	10	12—12½*
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111—114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾—6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 1/16—6 5/16
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	105—108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85—90
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼—5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	99—[illegible]
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½—10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾—8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾—⅞
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	11¾—12¾

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JULY 31ST TO AUGUST 29TH, 1905.

COPPER.



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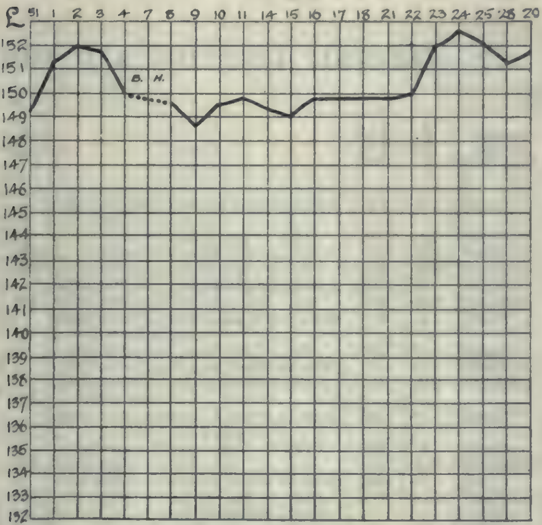

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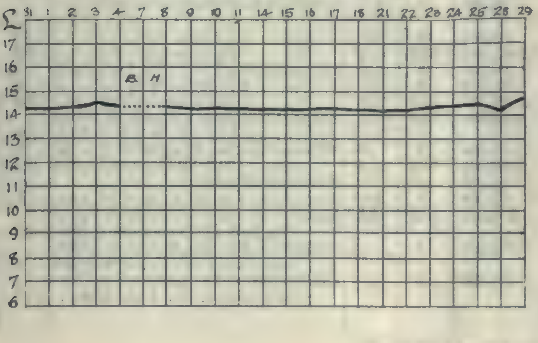

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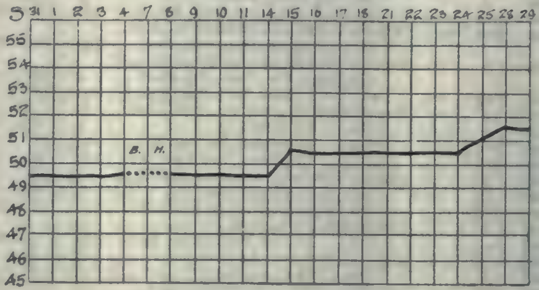

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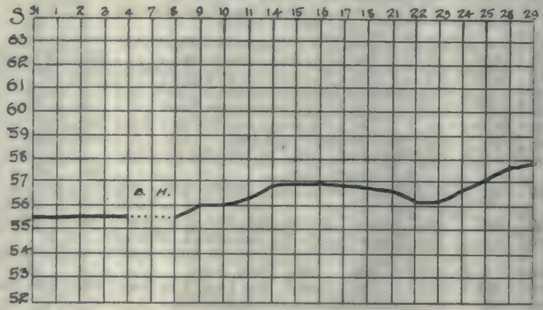

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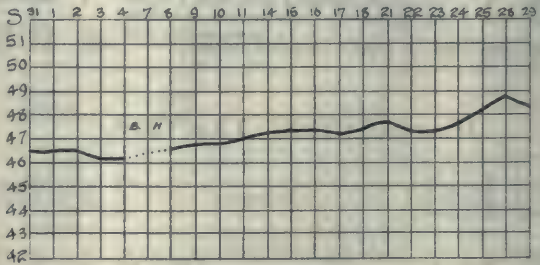

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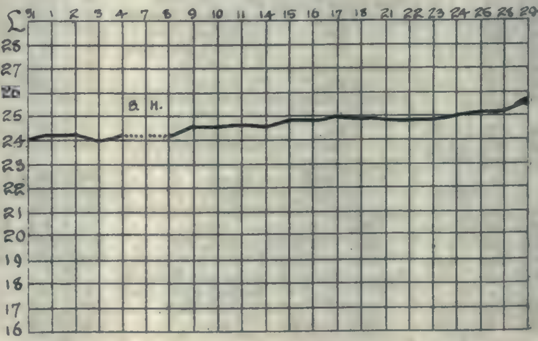


PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, August 30th, 1905.

THE prediction that copper would see higher prices has been amply realised, and in a market of remarkable strength the metal has been carried to £73. This best price has not been quite maintained, but the decline for the highest point is only fractional, and the statistical position suggests that sensational developments may be in store. As Merton and Co.'s last circular points out, the dearth of metal to which attention has been directed in this column has made itself felt even earlier than was anticipated, and for manufacturers the position is assuming a critical aspect. Consumers rudely awakened to the real state of affairs through an enormous demand upon dealers, who have sold at constantly rising prices. In the United States demand has altogether outstripped supply, and producers are unable to make any further sales for this year's delivery. Hence America is a buyer on the European market, and this will accentuate the stringency which is already in evidence. The closing prices are, cash £72 10s., and three months £72.

Tin has also moved upwards. On the revival of the American demand and a sharp rise in silver and cash tin at one time fetched £153. The arrivals from the East have been small, a strong control being exercised over the limited quantity of spot supplies. Although the latest prices show some reaction a fresh upward movement is extremely probable, the statistical position bringing out the scarcity of the metal very clearly. The closing prices are, cash £151 17s. 6d., and three months £151 2s. 6d.

On limited offerings and a good demand from consumers Spelter has made another move and Ordinaries are quoted at £25 10s. with Specials at £26 2s. 6d. A period of real scarcity appears to be imminent.

Lead has hardened, as notwithstanding the reserve shown by home consumers, there has been heavy Continental buying. American advices report a firm tone in the lead market on the other side. The closing prices for Soft Foreign prompt is £14 7s. 6d., and English £14 15s.

There is more speculative interest in the Iron and Steel section, an improving home trade and strong foreign advices having made for fresh confidence. There is a larger trade demand for all classes of material, and the reports of provincial correspondents are couched in a spirit of optimism which has hitherto been wanting from their weekly advices. A good effect has also been created by the news of an impending shipment of Middlesbrough iron to the United States although stocks are still very large. Cleveland cash warrants have improved to £2 8s. 4½d.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	7	0	0
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	10	0
STEEL	,, ,, Angles..................................	5	10	0

Manufactured Iron:

		£	s.	d.
Bars—Dalzell	....	6	5	0
,,	Best	6	15	0
,,	,, Horseshoe	6	15	0
,,	Angle..	6	5	0
,,	Best Angle	6	15	0
,,	Best Best	7	5	0
,,	Extra Best	7	15	0

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	10	0	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	10	0	,,
Glasgow ♛ ♛ Steel.				
Steel Bars, Boiler Quality	7	0	0	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

		£	s.	d.
Bars—Phœnix	....	6	5	0
,,	Best	6	15	0
,,	Best Best	7	5	0
,,	Extra Best..	7	15	0
,,	Best Horse Shoe	6	15	0
,,	Extra B.H.S.	7	15	0
,,	Extra Best Cable	8	5	0
,,	Rivet	6	5	0
,,	Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	—			2	14	0
Gartsherrie ,,	2	19	0	2	18	6
Summerlee ,,	2	18	0	2	13	6
Carnbroe ,,	2	15	6	2	13	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	18	6	2	13	6
Clyde ,,	2	18	6	2	12	0
Glengarnock, f.o.b. Ardrossan	2	18	0	2	13	0
Eglinton ,, ,,	2	14	6	2	12	0
Dalmellington, ,, Ayr	—			2	12	6
Shotts ,, Leith	2	18	6	2	14	0

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♔	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♔ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote :—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
♔ (P&K)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♔ W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote :—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:						
	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	12	5	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	10	0	,,

Galvanized Working Up-Sheets:	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	5	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote :—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	4½
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	4½
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	16	0	per ton.
Billets	at	3	18	0	,,
Sheet Bars	at	4	0	0	,,
Finished Steel:					
Bars	at	5	0	0	per ton.
Angles	at	5	1	0	,,
Tees	at	5	5	0	,,
Joists	at	4	12	6	,,
Fencing Standards	at	5	3	0	,,
Shoeing Bars	at	5	5	0	,,
Tyre Bars	at	5	5	0	,,
Half-Round Bars	at	5	10	0	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.		
English Ingots, f.o.b. Dis. 1¼% & 1%	152	0	0	to	152	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	153	0	0	to	153	10	0	,,
Straits G.M.B., cash Warehouse, Net	152	0	0	to	152	2	6	,,
Straits G.M.B., 3 months, Warehouse, Net	151	0	0	to	151	2	6	,,
Australian, Mt. Bischoff, Warehouse, Net	152	7	6	to	152	10	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	72	5	0	to	72	10	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net	71	17	6	to	72	0	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	77	0	0	to	77	10	0	,,
English, Best Select, Warehouse Net	78	0	0	to	78	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	86	0	0	to	87	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	82	0	0	to	83	0	0	,,
Electro, Warehouse, Net	78	0	0	to	78	5	0	,,
Ore, ex. ship	0	12	9	to	0	13	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	9	to	0	14	6	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	25	5	0	to	25	10	0	per ton.
Blende of 50 % Net	6	10	0	to	6	15	0	,,
Calamine, Net	6	15	0	to	7	0	0	,,

LEAD

	£	s.	d.		£	s.	d	
English Pig, Warehouse, Dis. 2½%	14	12	6	to	14	15	0	per ton.
Spanish, ex ship, Dis. 2½%	14	7	6	to	14	10	0	,,
Lead Ore of 70 %, Net	7	5	0	to	7	7	6	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	60	0	0	to	61	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	10	0	to	18	0	0	,,
Crude, ex ship, Dis. 2½ %	37	0	0	to	40	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	2	6	per flask
Italian ,, ,, ,,	7	0	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	1	0

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.	s.	d.
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	10	,,
	Tartaric at Manchester	0	0	10¾	,,

		£	s.	d.	
Acetate of Lime:	Brown at Manchester net	8	10	0	per ton.
	Grey ,,	11	15	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	11	3	,,
Arsenic:	Best White Powdered net	12	10	0	,,
Bleaching Powder, 35%	,,	4	7	6	,,
Borax:	British Refined Crystal ,,	13	0	0	,,
Coal Tar Products:					
	Benzole, 50/90 % ,,	0	0	7	per gal.
	,, 90% ,,	0	0	6½	,,
	Carbolic Acid Crystals, 34/35° C. ,,	0	0	5¾	per lb.
	,, ,, ,, 39/40° C. ,,	0	0	6⅛	,,
	,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
	,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	7½	,,
	Creosote, ordinary good liquid ,,	0	0	1⅜	,,
	Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
	,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8½	,,
	,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
	,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
	,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
	,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
	Naphthalene, all qualities.				
	Pitch f.a.s. Manchester. ,,	1	7	6	per ton.
Copperas:	Green, in bulk ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	17	6	,,
	Cake ,,	1	2	6	,,
Copper:	Sulphate	22	0	0	,,
Cyanides:	98% minimum f.o.b. net	0	0	7½	per lb.
Lead:	Acetate (Sugar) White, English	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	23	10	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	16	15	0	,,
	Nitrate	25	0	0	,,
	Litharge, Flake	16	10	0	,,
	,, Powder	17	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	16	0	0	,,
	White ,, ,, Dry ,, ,, ,,	17	0	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	6	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate... delivered England...	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull ...	18	0	0	per ton.
	Caustic, 75/80 % ,, ,, ...	20	5	0	,,
	Chlorate net	0	0	3 1/16	per lb.
	Montreal in Store, Liverpool	31	10	0	per ton.
	Prussiate Yellow net	0	0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined...... ,,	6	5	0	,,
	,, Carbonated, 48 %............ ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 %............... ,,	10	12	6	,,
	,, ,, 70 %................ ,,	9	12	6	,,
	,, ,, 60 %................ ,,	8	12	6	,,
	,, Cream, 60 %..... .... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	3$\frac{1}{16}$	per lb.
	Nitrate...ex quay Liverpool, ... ,,	10	10	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)................	1	10	0	,,
	,, (Saltcake, 95%)................	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers....................................	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	9	0	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports..........	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC .... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55%	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %..............	91	0	0	to	93	0	0	per ton.
Lead Ore, 70%					6	19	0	,,
Blende, 50%					6	9	6	,,
Calamine........................					6	12	0	,,
Antimony Ore, 50%......	20	0	0	to	22	0	0	,, nom.

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	6	4	per ton.
Do.	,,	Cartagena	6	7	,,
Special low phos.	,,	Porman	6	10	,,
Do. do.	,,	Cartagena............	7	0	,,
Extra quality do.	,,	,, ...	7	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.	,,	,, ...	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine...............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	2	6		7	7	6
Nova Scotia Spruce...........	,,	7	0	0		7	5	0
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak...............	per load	12	0	0		16	0	0
Greenheart......	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When patents have been communicated the names of the communicators are printed in *italics*.

15256. P. W. Noble, Coventry. July 25th.—Improvements in carburettors and the like.

15266. F. Danesi, London. July 25th.—Improvements in self-acting valves.

15272. A. H. Farmer, London. July 25th.—Improvements in steel valves.

15278. H. H. Lake, London. July 25th.—Improvements relating to gas reversing valves. (*H. Erns Schild, Mexico.*)

15305. H. H. Lake, London. July 25th.—Improvements relating to water tube boilers. (*A. Genardini, Italy.*)

15310. J. Schnell, London. July 25th.—Improved turn table.

15352. G. C. Vernon-Inkpen, Rowland's Castle. July 26th.—Improvements in carburetters of internal combustion engines, and the like.

16455. M. Hopkins, London. August 14th.—Improvements in and relating to variable speed gear.

16487. A. Lehmann, London. August 14th.—An improved exhaust silencer for internal combustion engines.

16497. R. A. Dawbarn, London. August 14th.—Improvements in and relating to steam engines.

16511. W. Willeringhaus, London. August 14th.—Improvements in ventilating fans. (*G. Kiefer, Germany.*)

16550. W. J. Robb, London. August 15th.—Improvements in or relating to explosion and other engines.

16580. A. Schatz, London. August 15th.—Improvements in lifting jacks.

16582. J. H. Elspass, London. August 15th.—Improvements in rock crushers.

16592. R. Haddan, London. August 15th.—Improvements in steam engines, air compressors, and the like. (*F. S. Hyde, United States.*)

16640. J. E. Mathewson, London. August 16th.—Improved mode of preventing the slipping of belts on pulleys.

16641. H. E. Newton, London. August 16th.—Improvements in centrifugal turbines, and similar pumps. (*H. R. Worthington, U.S.A.*)

16646. S. J. Sennett, London. August 16th.—Automatic type-casting machine.

16653. A. Shaw, London. August 16th.—Improvements in rotary pumps, blowers and the like.

16661. R. Kennedy, Glasgow. August 17th—Improvements in exhaust ejectors for internal combustion engines.

16671. J. Swinburne, London. August 17th.—Electric working of mine shafts.

16678. J. Dunlop, and D. Stewart, London. August 17th.—Improvements in gas-producing plant.

16679. J. Dunlop, and D. Stewart, London. August 17th.—Improvements in internal combustion motors.

16689. S. Mertens, London. August 17th.—Sectional boiler.

16703. S. Luhr, London. August 17th—Improvements in, and relating to, brick-moulding machines.

16730. G. Miller, London. August 17th.—A new or improved compound-acting slide valve for steam engines.

16737. C. Merrington, Hants. August 18th.—Improvements in internal combustion engines.

16750. R. Lindsay, London. August 18th.—Variable speed gear.

16818. J. D. Ellis, Aberystwyth. August 19th.—Adjusting eccentric.

16860. F. Marberg, London. August 19th.—Improvements in screw propeller pumps and blowers.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN TERMINAL RODS OR CONDUCTORS OF SPARKING PLUGS FOR INTERNAL COMBUSTION OR EXPLOSION ENGINES.

F. R. Simms, of Kilburn, and R. Bosch, of Stuttgart, in the German Empire. Feb. 23rd, 1905.—This invention relates to the manufacture of terminal rods or conductors of sparking plugs for internal combustion or explosion engines and comprises the improvements hereinafter described. In the accompanying drawing: Fig. 1 is a sectional view of the sparking plug of ordinary construction. Fig. 2 is an end view thereof. Figs. 3 and 4 are a side and end view respectively of a novel form of terminal rod or conductor according to the invention and is shown in an intermediate stage in the manufacture, and figs. 5 and 6 are views similar to figs. 3 and 4, respectively of the finished rod or conductor. This invention has for its object to provide means whereby the manufacture of terminal rods or conductors is simplified and a better device is, at the same time, obtained. According to the invention drawn, stamped and rolled material only is employed, preferably wire or tube. The wire can have advantageously from the outset the desired thickness of the conductor. A piece of suitable length is cut off and provided with the screw thread. The end of the wire is then formed into a suitable number of segments by the formation of longitudinal slots as shown in figs. 3 and 4 after an axial hole has been bored therein. The shoulder consists of a stamped disc, which accurately fits the rod and is passed on to the same to the root of the slotted portion, the segments obtained as above described being then bent back as shown in figs. 5 and 6. In this way the material of the rod is expanded within the shoulder so as to hold the same securely in place, and the ends of the segmental strips are approached towards the edge of the sparking plug to form the necessary sparking gap. The above method of manufacture is considerably simpler than that usually followed. Conductors so made also possess the distinct advantage that they can be much more easily adjusted to the proper sparking position than conductors as now made, the length of the separate strips forming the head permitting their distance from the edge of the plug, to be altered by bending, and as the method of manufacture allows of the employment of drawn or rolled material, this bending can be made use of without the liability of fracture of these strips taking place.

Fig. 1.

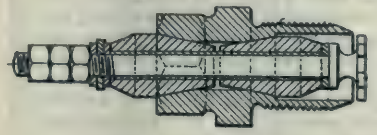


Fig. 2.

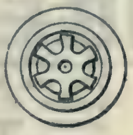


Fig. 3.

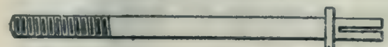


Fig. 4.

Fig. 5.

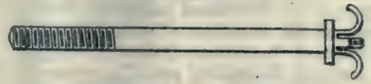


Fig. 6.

CENTRIFUGAL SPEED REGULATOR.

R. H. Lewis, Maryland, U.S.A. May 11th 1905. —This invention relates to speed regulators and especially to a centrifugal speed-controlling device. The object of the invention is to provide a novel and peculiar construction and arrangement of parts in a device for controlling speed which shall quickly and positively co-act with the element under its control. A further object is to provide a specially-arranged mechanism for controlling the movement of a sprocket chain wheel and to devise a peculiar frame for mounting the said wheel and mechanism together thereon so that they may be suspended in operative position as desired without separate adjustment thereof. Fig. 1 of the drawings is an elevation of the device applied as a fire escape, partly broken away. Fig. 2 is a top or edge view of the device. Fig 3 is an enlarged central longitudinal section partly broken away. Fig. 4 is a section on the line x-x, fig 2. Fig. 5 is a detail perspective view of one of the shoes, and fig. 6 is a similar view showing a modification of the shoes. The speed-controlling device being devised especially to control the fall of a fire-escape chain, it is for purposes of exemplification shown suspended from a window by a frame having a circular flange projecting therefrom and forming a housing, an arm extending from the housing and pivoted to swing from a fixed bracket. A shaft works in and through a lug, one end having a sprocket wheel and the other end having a gear wheel attached thereto. Sprocket wheel has a guard for a chain which operates the said wheel. The pair of friction blocks which constitute the brake shoes have non-frictional faces which incline from each other to the periphery of the shoes, and each shoe has a U-shaped cavity at the juncture of the faces. The brake shoes are loose upon pins and are revolved by the latter through the medium of a gear and pinion to which motion is imparted by the movement of the chain sprocket.

Fig. 1.

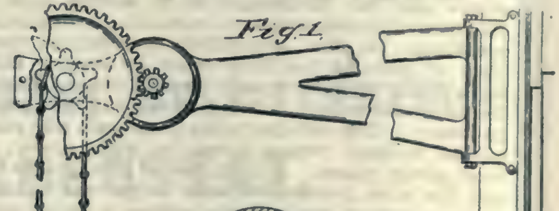


Fig. 4.

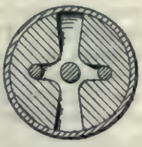


Fig. 2.

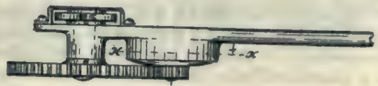


Fig. 3.

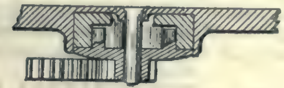


Fig. 5.

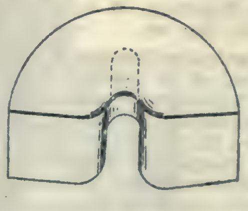
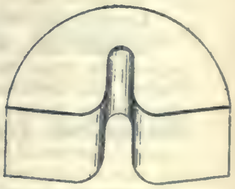


Fig. 6.



Thus the shoes are swung around and in frictional bearing with the casing to effect braking. Should the frictional brake surfaces become worn, the revolution of the pins will throw the shoes outwardly (they being prevented from inward movement by the pins) into engagement with the casing and effect braking just the same.

NEW PUBLICATIONS.

"NATIONAL ENGINEERING AND TRADE LECTURES."

Edited by Ben H. Morgan. Volume II.—British Progress in Pumps and Pumping Engines. By Philip R. Bjorling. Volume III.—British Progress in Gas Works Plant and Machinery. By C. E. Brackenbury, A.M.Inst.C.E. Archibald Constable and Co., Ltd. 6s. each net.

When calling attention to the first volume of this series of lectures we mentioned that the primary object of the scheme was to demonstrate to colonial and foreign purchasers what progress Great Britain has made up to the present time in the manufacture of all classes of machinery and goods. Each lecture emphasises some novel points of design and utility, and up-to-date methods. The first volume deals with municipal engineering, and although the two succeeding works are scarcely likely to evoke such wide-spread interest, they will unquestionably be found valuable additions to the literature of each particular subject. In his introductory remarks Mr. Bjorling gives some valuable advice on the selection of pumps and the advantages to be derived from the utilisation of electric motors in connection with pumping operations. He then proceeds to describe the different types of pumping machines made by leading British firms, calling attention to such features of their construction as should be kept in mind by users of this kind of machinery. The early part of the book treats with pumps worked by hand, pumps driven by water power, and wind power pumps. A collection of photographs illustrate the more prominent makes of gas and oil engine pumps, and then consideration is given to hot air pumps and compressed air pumps. The greater part of the volume is, of course, taken up by a study of steam pressure pumps. In the third volume Mr. Brackenbury gives a comprehensive review of the plant and machinery involved in gas works, from the receiving and manipulation of the raw material to the gasholder storage of the gas. The scope is a wide one, embracing, locomotives for shunting purposes, elevators, conveyors, retort houses and benches, retort stoking machinery, inclined retorts, coke plants, condensers, exhausters, washer scrubbers, purifiers, station meters, gasholders, station governors, water gas plant, gas appliances. In conclusion, mention is made of the by-products of the gas industry. Included in each volume is a classified list of British firms interested in the manufacture of the various productions under discussion. The publishers are to be congratulated on the format of the books, the type, paper and illustrations being all that could be desired in works of this nature.

"EXPERIMENTAL ELECTRICITY."

By William Cecil Dampier Whetham, M.A., F.R.S. Cambridge University Press. 8s. net.

The latest addition to the "Cambridge Physical Science Series" is from the pen of one of its general editors. During his experience as a Cambridge lecturer on the elementary theory of experimental electricity, Mr. Whetham came to the conclusion that the recent developments in physical science had changed the proportion of the various branches of the subject and that some of the older text-books were no longer suitable for the purpose for which they were intended. The present work is the outcome of the necessity he felt for a text-book which should correspond with the stage now reached in the evolution of teaching, and to which the students could turn for further elucidation of the points not clear to them. The writer divides his subject into twelve divisions as follows: general principles of electrostatics; some theorums of electrostatics; the dielectric medium; magnetism; the electric current; thermo-electricity; electro-magnetic induction; electrical units; electro-magnetic waves; electrolysis; the conduction of electricity through gases, and radio-activity. The author warns the student that he has here made no attempt to present a complete treatment of the science of electricity. The book, he says, is meant to be suggestive rather than exhaustive, to be an impressionist sketch rather than a finished picture.

NEW CATALOGUES.

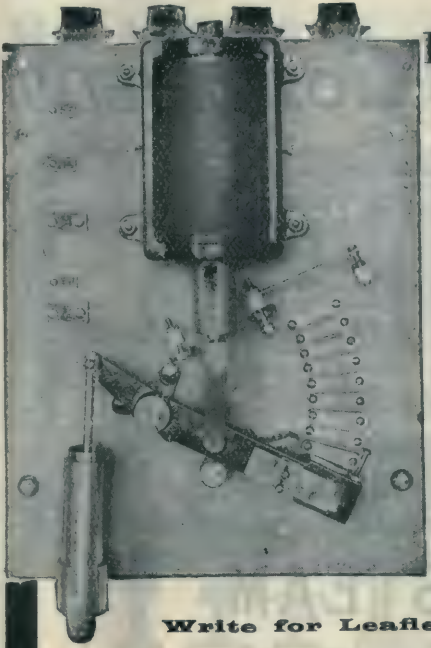
The General Electric Company, Ltd., 71, Queen Victoria Street, E.C. Several new and up to date catalogues and pamphlets have been issued by this firm during the past few weeks, prominent being an illustrated catalogue of "Witton" single and polyphase induction motors. This will be found useful for reference as it includes a number of tables giving tabulated details of various motors, together with prices. The firm's illustrated catalogue of wires and cables, porcelain insulators, leading-in tubes, insulating material, wiremen's tools, accessories, etc., has now reached its twelth edition. A handy series of accessories in the shape of electric pocket lamps is described in Pamphlet No. O 1085, and an attractive facsimile calls attention to a cheap form of battery wall telephone suitable for short line installations, such as office to warehouse, house to stables, etc., etc.

Edward Bennis and Co., Ltd., Bolton and Westminster, etc. Some exceptionally interesting and convincing tests showing the comparative economies between the Bennis system and the ordinary way of stoking have been bound up together in an illustrated pamphlet, and will be found worthy of the attention of steam users. Prominent is a large view of the Bennis Patent Stoking and complete Coal and Ash Elevating and Conveying Plant, as fitted to 36 furnaces at the Carlton Main Colliery Company's (Ltd.) Grimethorpe Colliery, near Barnsley. Repeat orders have been received this year for two similar plants for the same company, making in all 64 furnaces.

The Kilgore-Peteler Company, Minneapolis, Minn., U.S.A., send us an attractively printed list of dump cars for heavy steam shovel, mining and other work. The prominent feature of these cars is a patent device which can be easily operated by one man. In place of side chains to hold the car in an upright position, a dump stand bar with roller bearings is used. These bearings roll along the bottom of the car body when the lever pulls the dump stand bar over. This gives a solid bearing for the car body and is of great advantage in steam shovel work where the material is dropped from the dipper, as the car is held absolutely rigid.

Messrs. W. and T. Avery, Ltd., Soho Foundry, Birmingham. Sheet No. 138 describes and illustrates Avery's Patent Automatic Weighbridge for the quick weighing of railway traffic without stopping the trains. This invention has been designed to practically eliminate friction by reducing to a minimum the number of spindles, with their consequent disadvantages; the weighing being accomplished by means of cylinders carrying pendulum weights, which roll up steel bands and by actuating a pointer indicate the exact weight upon the dial. The indicating mechanism is relieved from wear when not in use by movement of a hand-lever. The following advantages are claimed for the weighbridge: (1) saving in time of all train attendants and weighman; (2) quicker train transit with it attendant economics; (3) earlier delivery of produce at the large congested centres.

PAGE'S WEEKLY Miscellaneous



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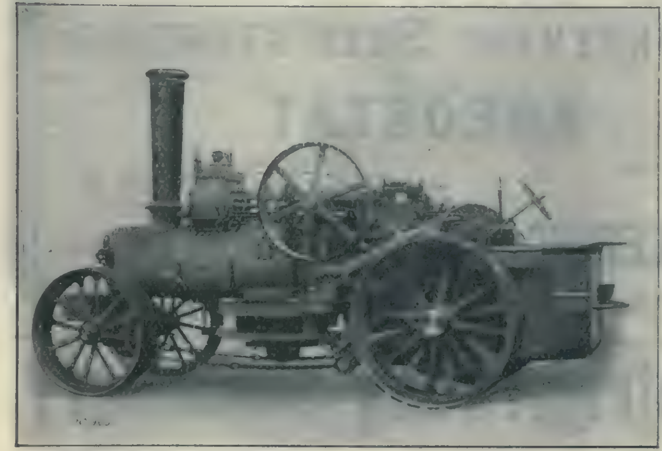

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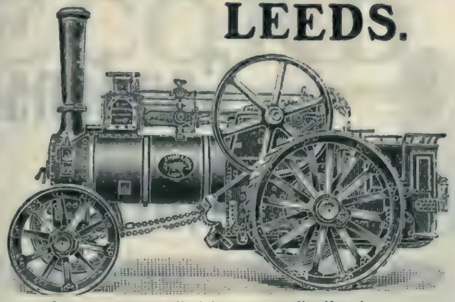

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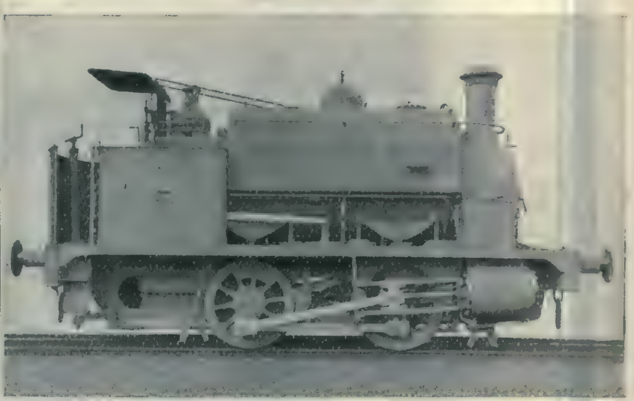

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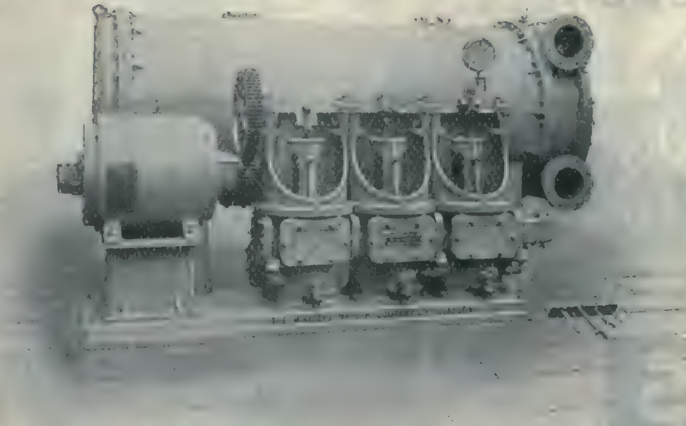

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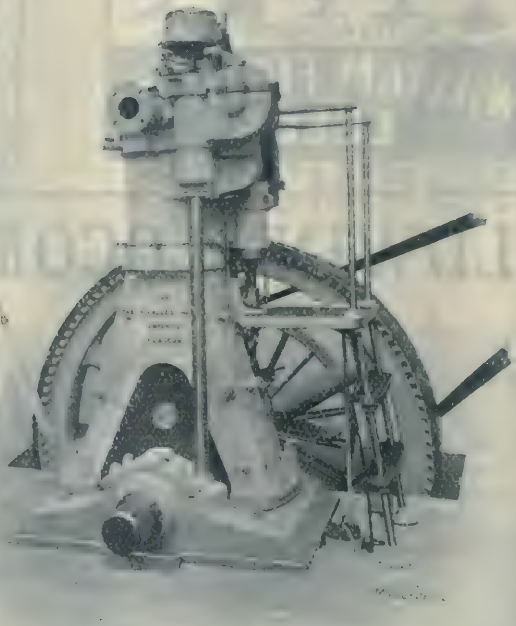

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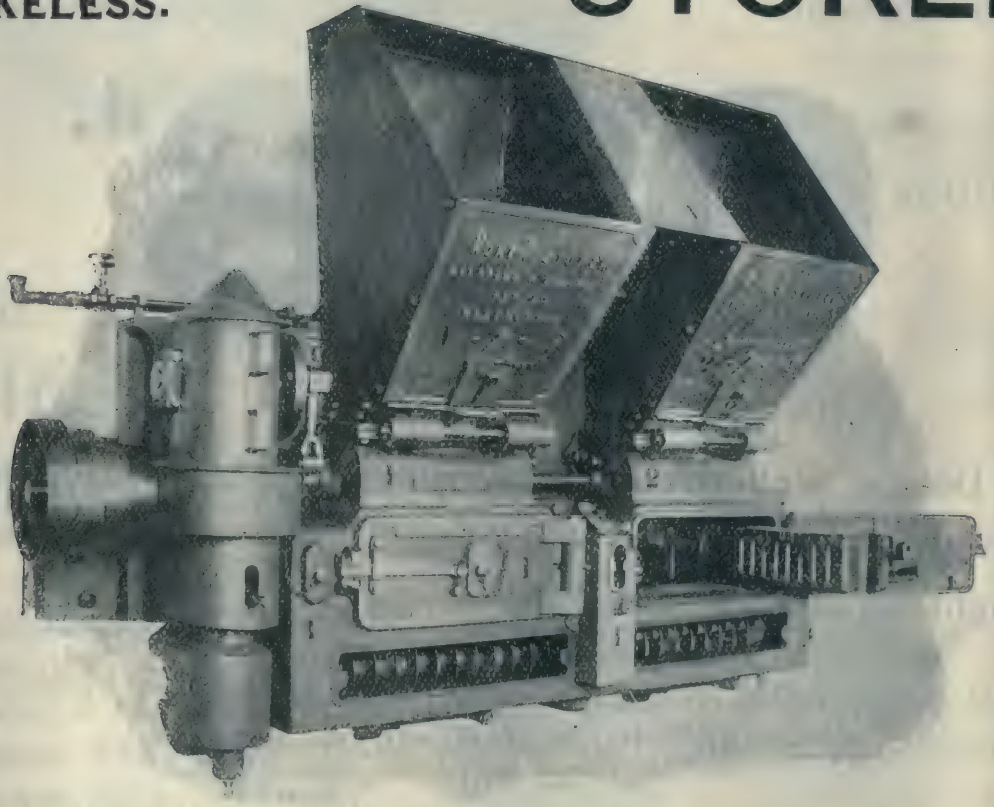

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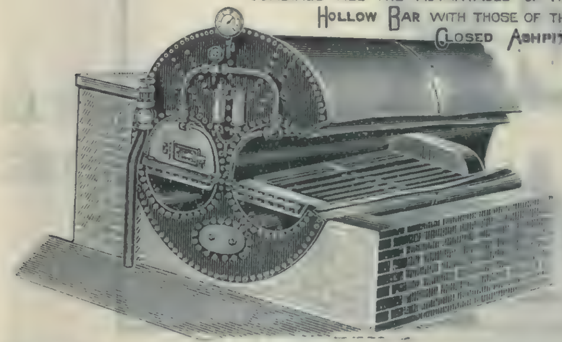

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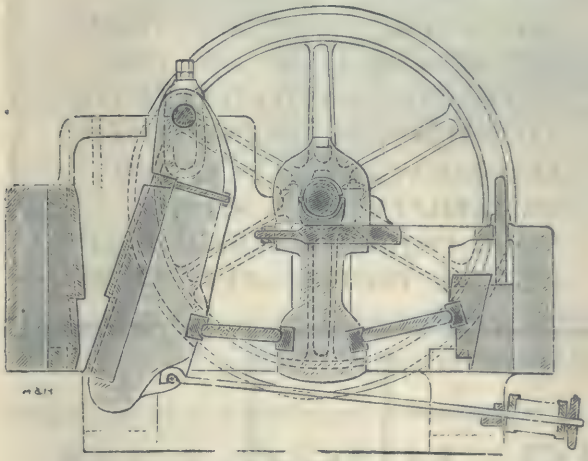

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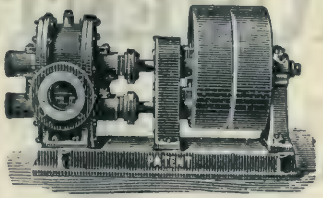

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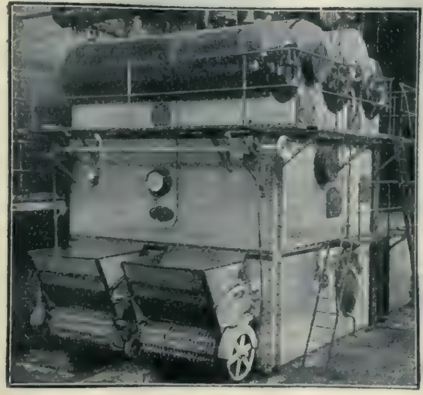

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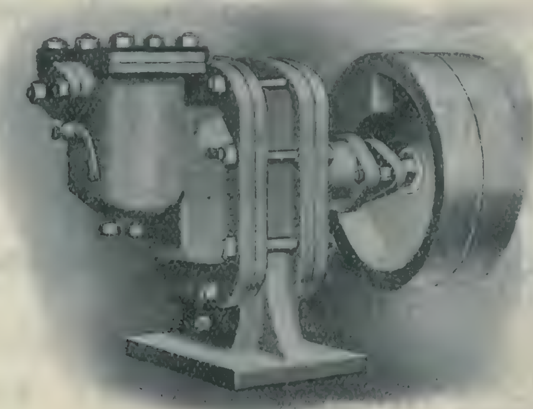

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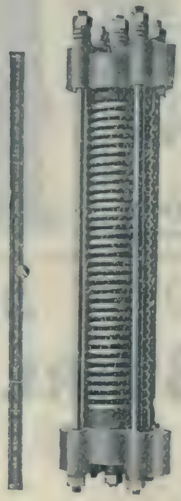

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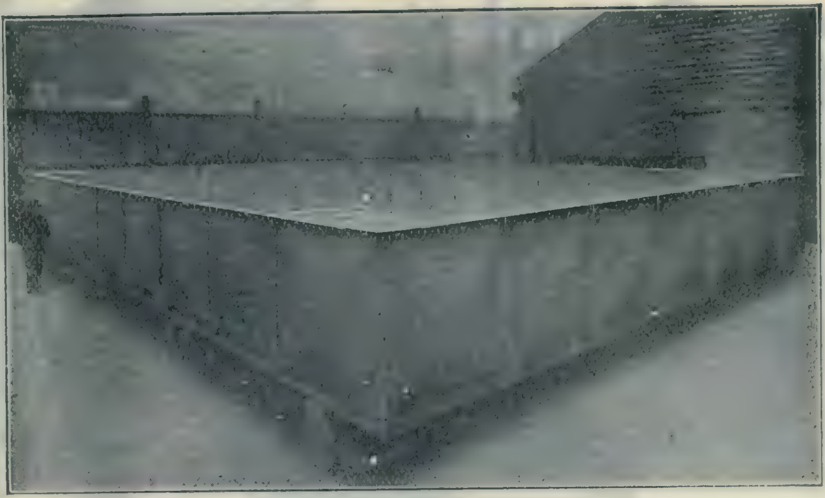

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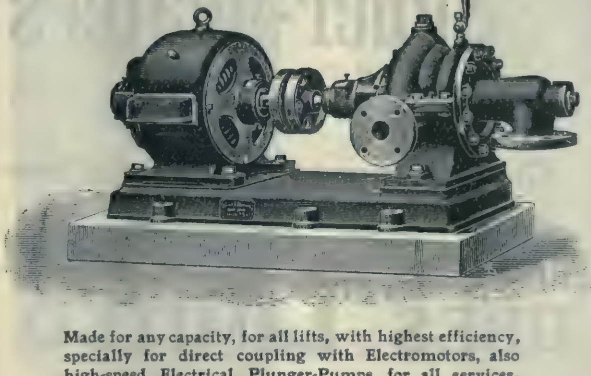

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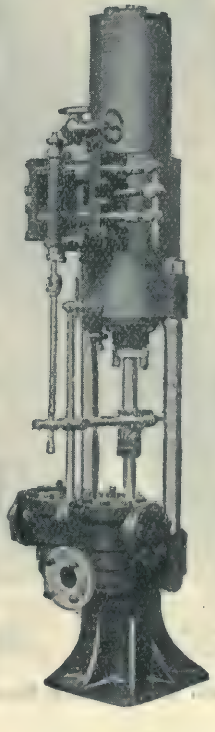

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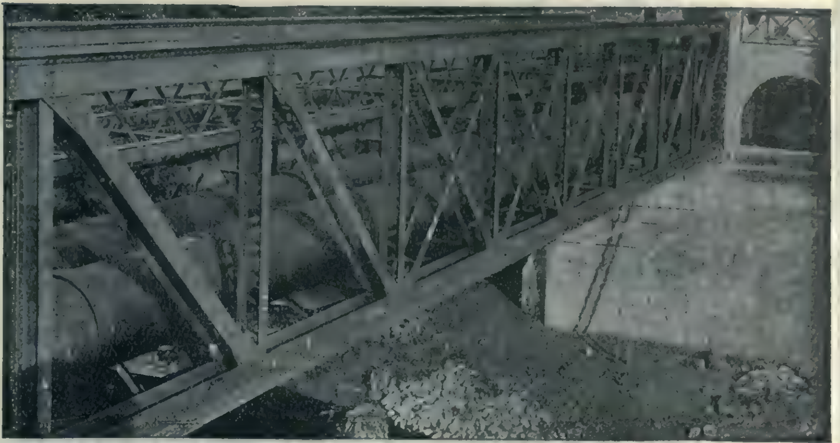

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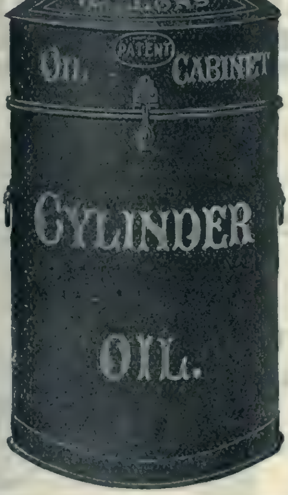

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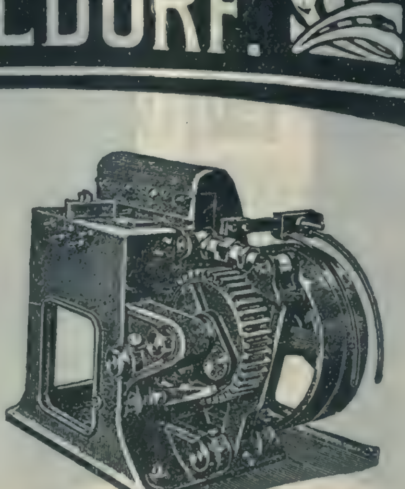

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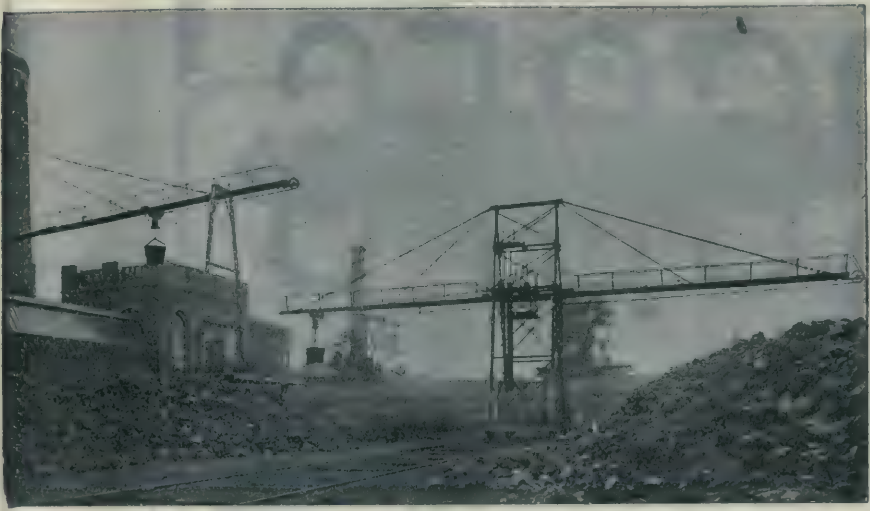

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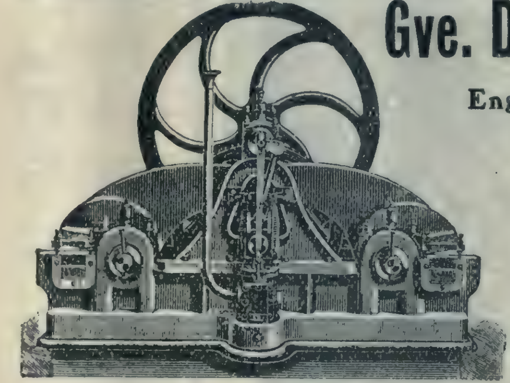

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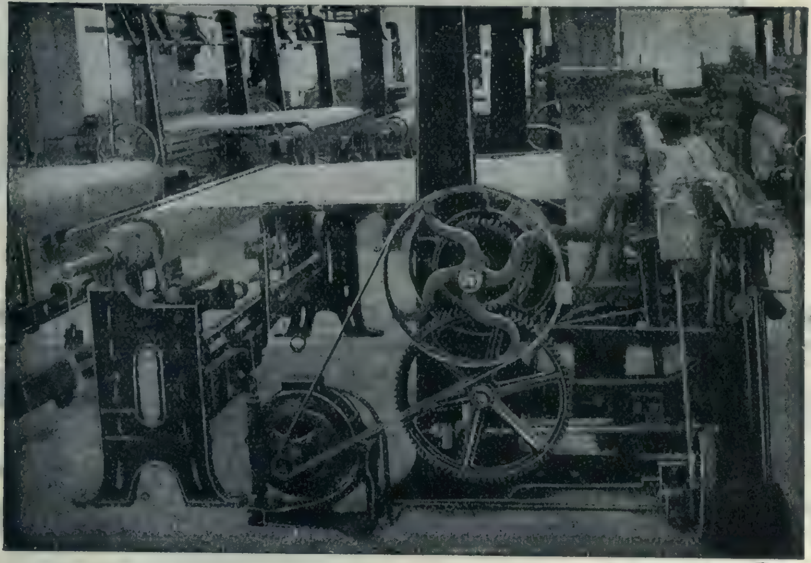

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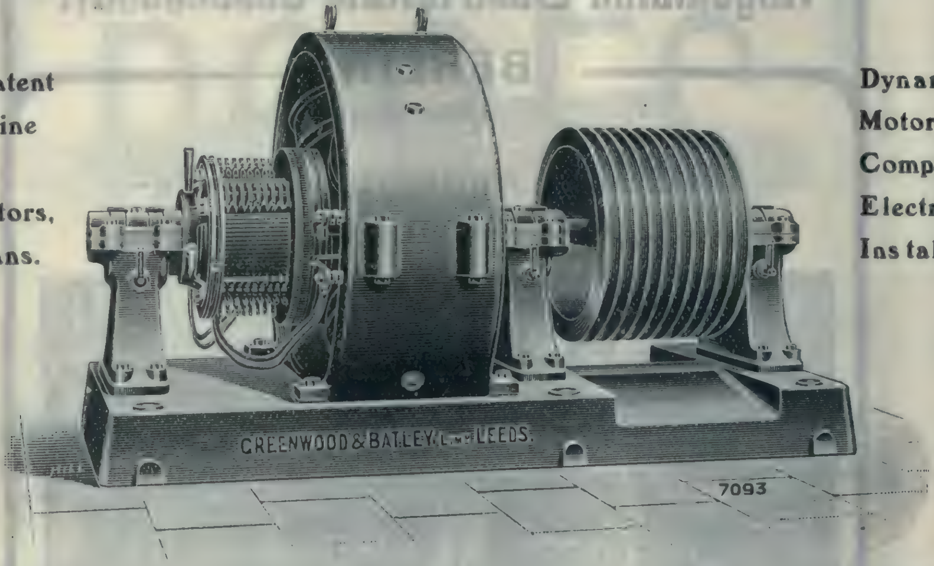

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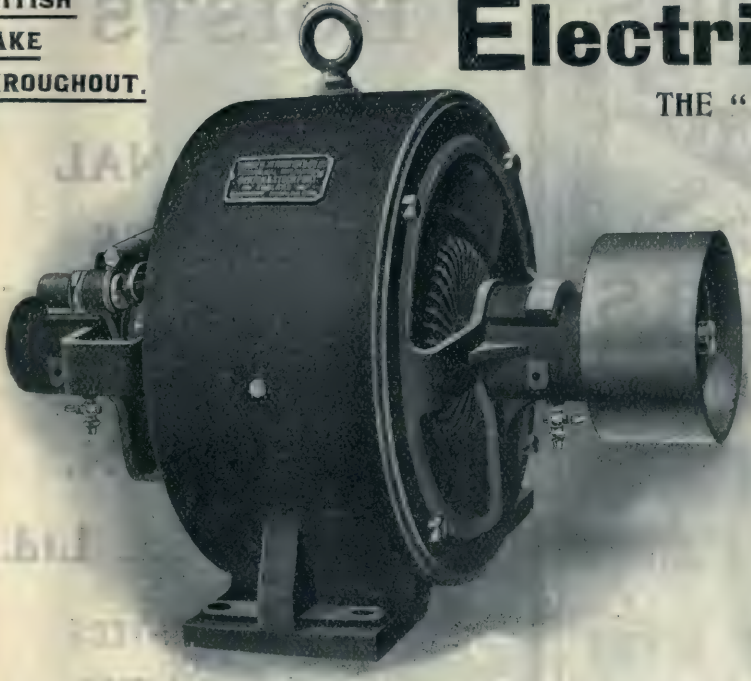

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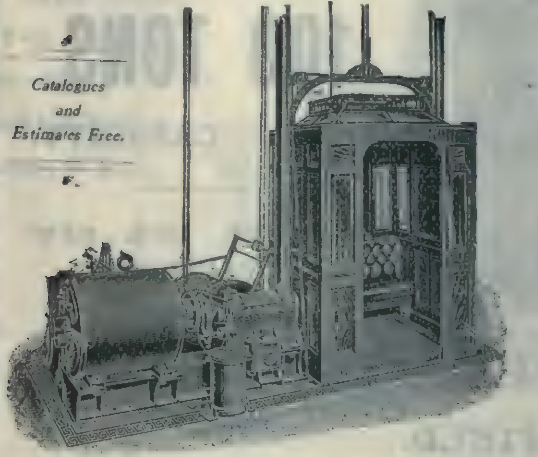

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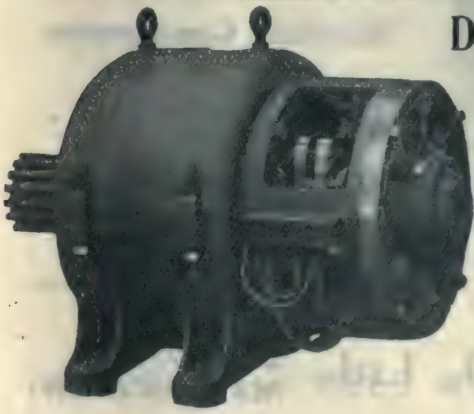

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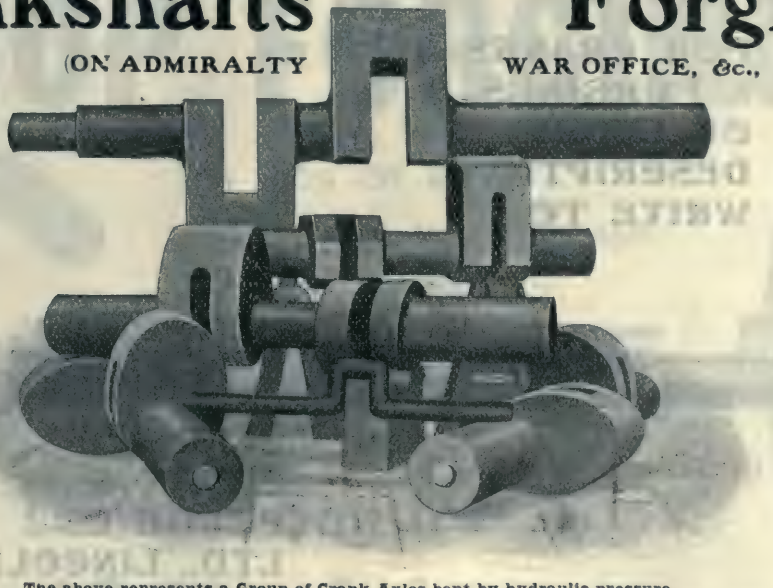

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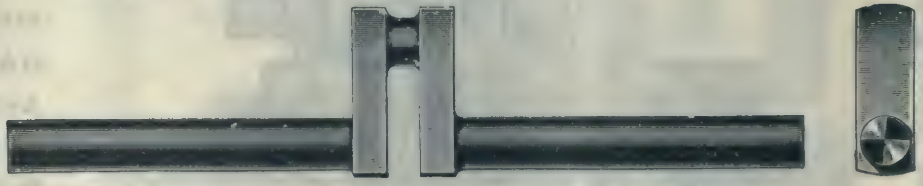

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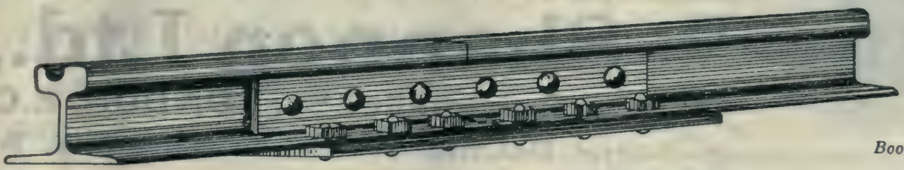

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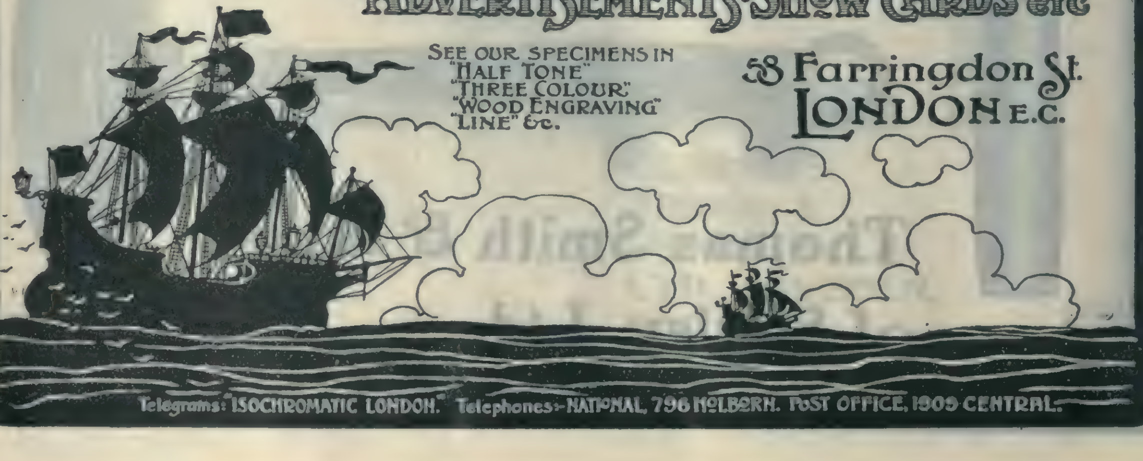

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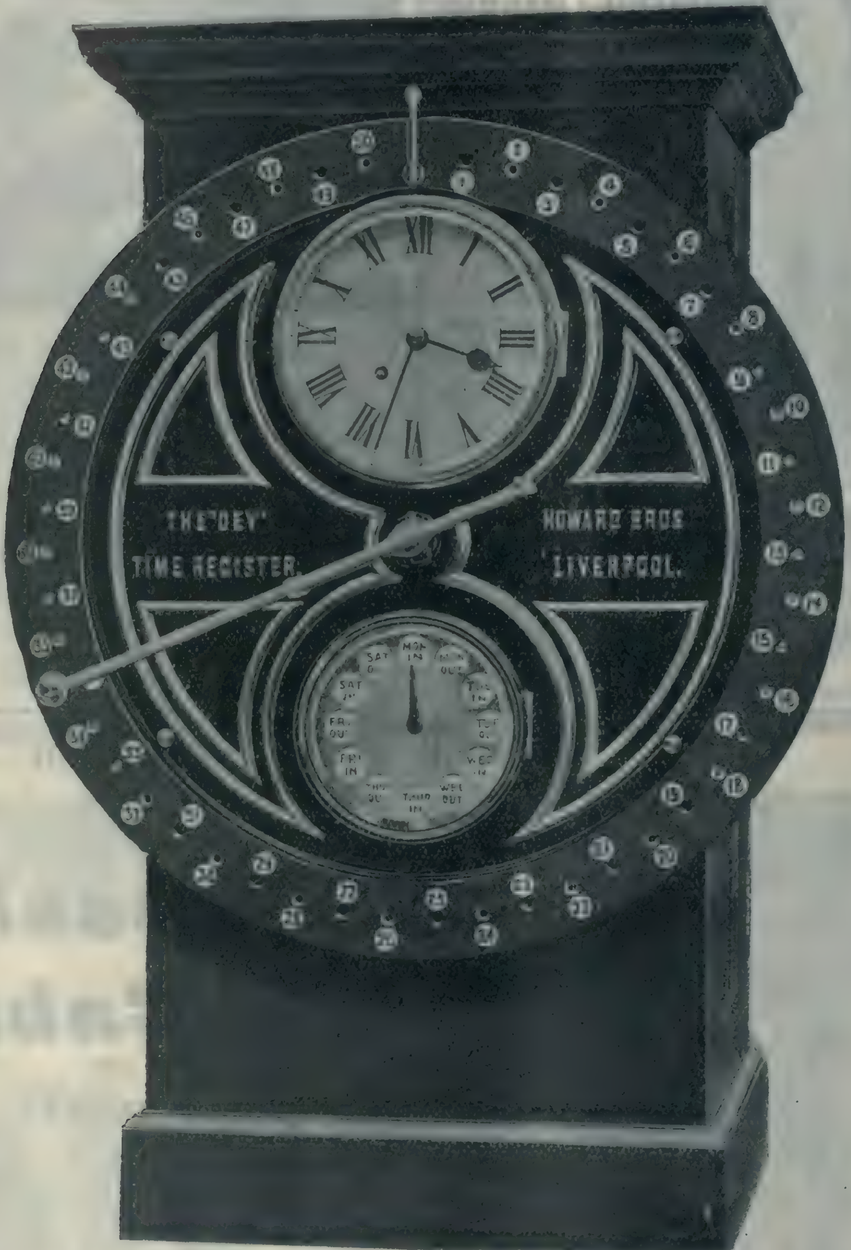

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	For Intermediate Stations ...	6.5 p.m.
† 11.0 a.m. from	Victoria Station	6.45 p.m.
‡ 9.0 p.m. „	Charing Cross Station ...	5.50 a.m.

Depart. from Paris.		Arrival in London.	
† 8.30 a.m.	For Intermediate Stations	4.55 p.m.	Charing Cross Station.
†* 9.50 a.m.	For CALAIS only		
†* 11.35 a.m.	... ...	6.45 p.m.	Victoria Station
‡ 8.40 p.m.	... Intermediate Stations	5.40 a.m.	Charing Cross Station.

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Depart. from London.		Arrival in Paris.
‡ 10.0 a.m.	from Charing Cross Station ...	6.5 p.m.
†* 2.20 p.m.		9.15 p.m.
‡ 2.20 p.m.		11.25 p.m.

Depart. from Paris.		Arrival in London.	
‡ 8.30 a.m.	Intermediate Stations	... 3.45 p.m.	Charing Cross Station.
‡ 2.40 p.m.		10.45 p.m.	
†* 4.0 p.m.	For Boulogne only ...		

† 1st and 2nd Class only. ‡ 1st, 2nd, and 3rd Class. * Restaurant Car between Paris and Calais or Boulogne, and *vice versâ*.

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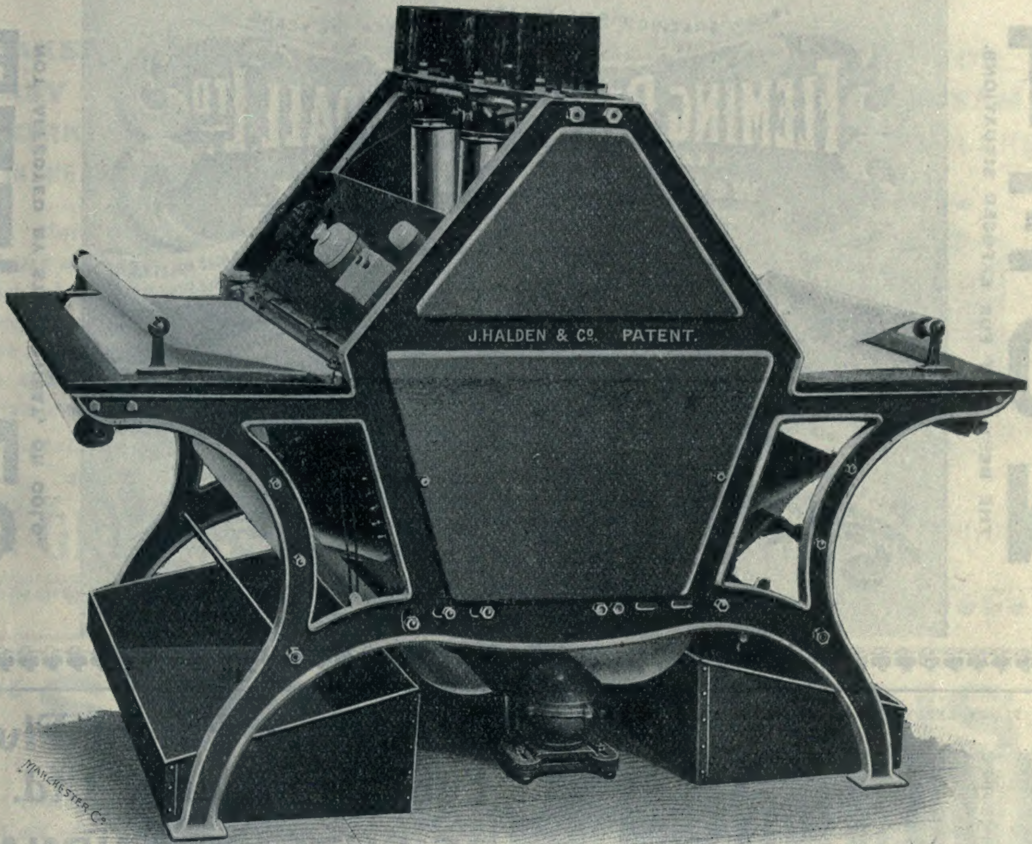

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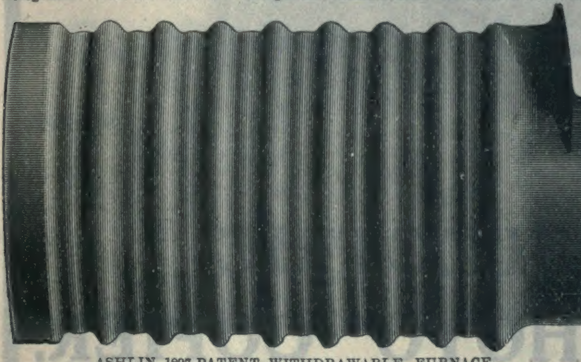

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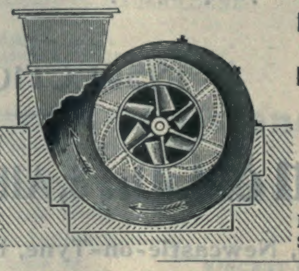

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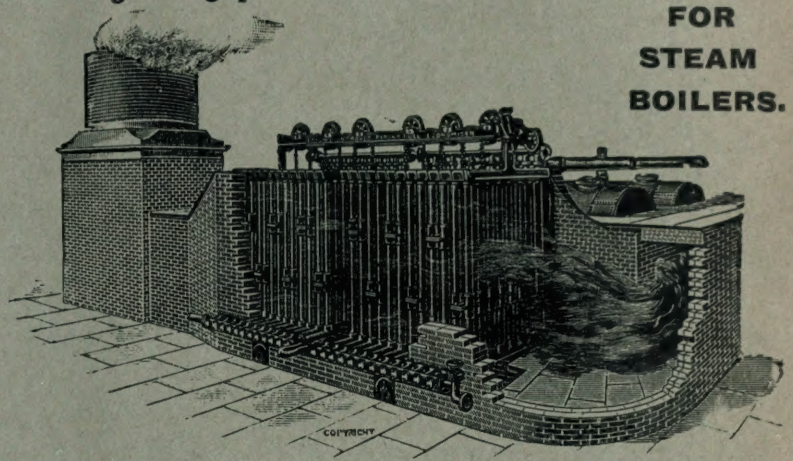

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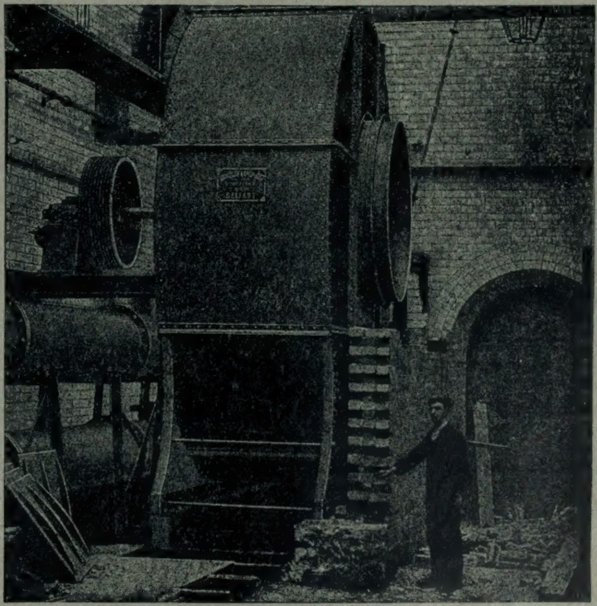

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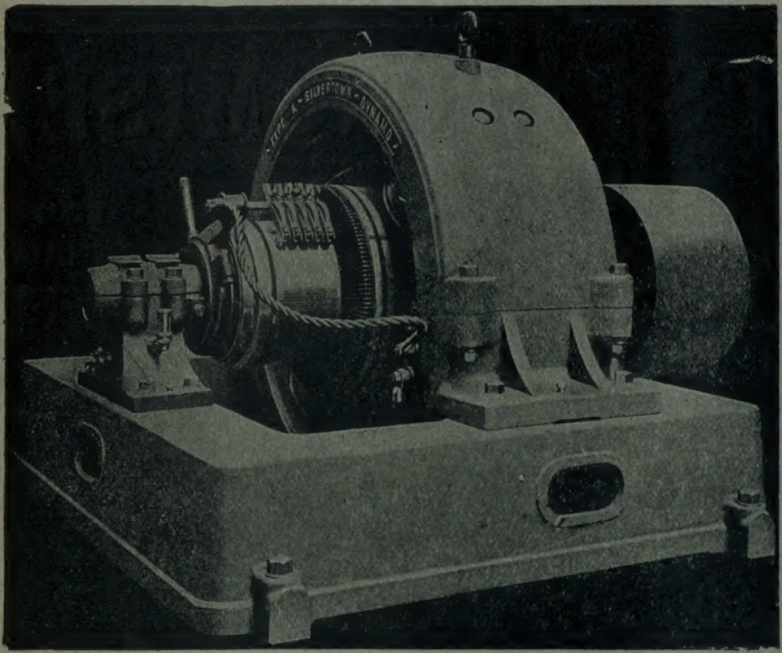

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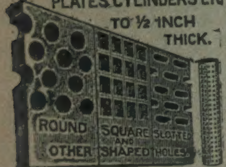

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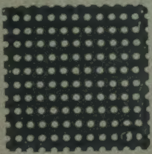

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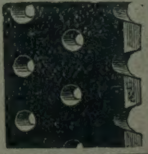

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